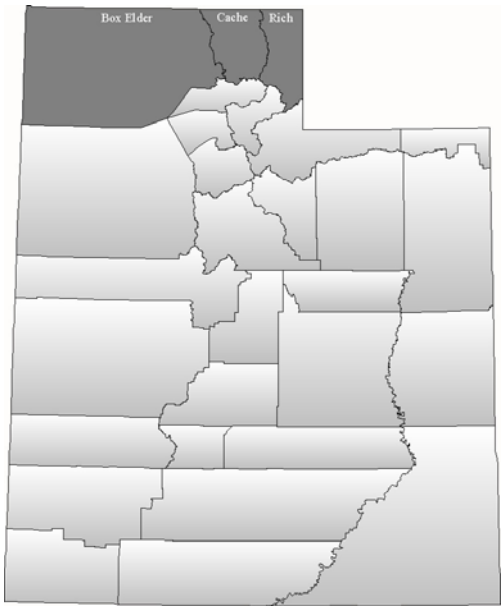
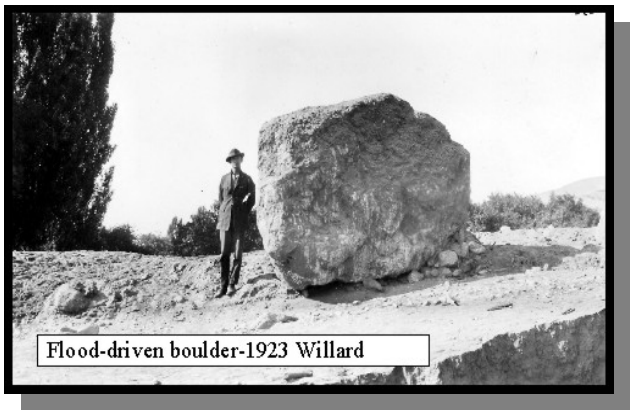
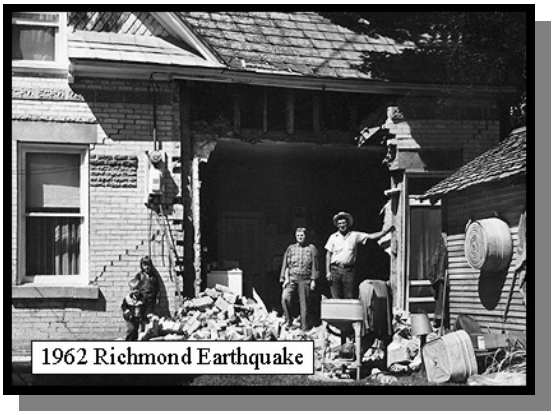


Pre-Disaster Mitigation Plan

Northernmost Utah's Bear River District

Box Elder, Cache & Rich Counties


Flood-driven boulder-1923 Willard


1962 Richmond Earthquake


1962 Richmond, Earthquake


Main Street Willard-1923 Flood

Bear River Association of Governments
December 2003

Photographs Courtesy of Special Collections
Utah State University

PRE-DISASTER MITIGATION PLAN
BEAR RIVER DISTRICT, UTAH

December 2003

Bear River Association of Governments

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PART I: PRE-REQUISTES & ADOPTION BY THE LOCAL JURISDICTIONS

INTRODUCTION

The three northernmost Utah counties that makes up the Bear River District is vulnerable to natural, technological, and man-made hazards that have the possibility of causing serious threat to the health, welfare, and security of our citizens. The cost of response to and recovery, both in terms of potential loss of life or property, from potential disasters can be lessened when attention is turned to mitigating their impacts and effects before they occur or re-occur.

This plan attempts to identify the region's hazards, understand our vulnerabilities and craft solutions that can significantly reduce threat to life and property. The plan is based on the premise that hazard mitigation works! With increased attention to managing natural hazards, communities can do much to reduce threats to existing citizens and avoid creating new problems in the future. In addition, many solutions can be implemented at minimal cost.

This is not an emergency response or management plan. Certainly, the plan can be used to identify weaknesses and refocus emergency response planning. Enhanced emergency response planning is an important mitigation strategy. However, the focus of this plan is to support better decision making directed toward avoidance of future risks and the implementation of activities or projects that will eliminate or reduce the risk for those that may already have exposure to a natural hazard threat.

HOW THE PLAN IS ORGANIZED

Part I of the plan provides a general overview of the process, the scope, purpose and overall goals of the plan. Part II documents the planning process and public involvement component of the plan. Part III gives some general background on the region's demographic, economic and physiographic characteristics.

Part IV the Risk Assessment section provides definitions for each natural hazard and documents how the hazards were chosen for analysis and discussion. Organized by "Annex" histories were compiled, and a risk assessment was performed for each of the identified natural hazards. Because of the uniformity of the hazard risk through out the region and the similarity of the vulnerabilities, agricultural related hazards (severe weather, drought, insect infestation) were analyzed at the regional or Bear River District level (Box Elder, Cache and Rich Counties) in the Bear River District Annex. All the other hazards were analyzed and discussed at the county/community level in each of the three "county annexes". This allowed the core of the location specific information for each county to be in one section.

Part V presents a capability assessment for the district. This section documents the staffing and personnel capabilities for each of the included jurisdictions. Finally, Part VI discusses the ongoing plan maintenance strategy and details efforts to get the recommendations of the plan incorporated in local land use planning and other decision making processes.

HOW THE PLAN SHOULD BE USED

First, the plan should be used to help local elected and appointed officials plan, design and implement programs and projects that will help reduce their community's vulnerability to natural hazards. Second, the plan should be used to facilitate inter-jurisdictional coordination and collaboration related to natural hazard mitigation planning and implementation. Third, the plan should be used to develop or provide guidance for local emergency response planning. Finally, if adopted, the plan will bring communities in compliance with the Disaster Mitigation Act of 2000.

WHAT IS HAZARD MITIGATION?

Hazard mitigation is defined as any cost-effective action(s) that has the effect of reducing, limiting, or preventing vulnerability of people, property, and the environment to potentially damaging, harmful, or costly hazards. Hazard mitigation measures, which can be used to eliminate or minimize the risk to life and property, fall into three categories. First: are those that keep the hazard away from people, property, and structures. Second: are those that keep people, property, and structures away from the hazard. Third: are those that do not address the hazard at all but rather reduce the impact of the hazard on the victims such as insurance. This mitigation plan has strategies that fall into all three categories.

Hazard mitigation measures must be practical, cost effective, and environmentally and politically acceptable. Actions taken to limit the vulnerability of society to hazards must not in themselves be more costly than the value of anticipated damages.

The primary focus of hazard mitigation actions must be at the point at which capital investment decisions are made and based on vulnerability. Capital investments, whether for homes, roads public utilities, pipelines, power plants, or public works, determine to a large extent the nature and degree of hazard vulnerability of a community. Once a capital facility is in place, very few opportunities will present themselves over the useful life of the facility to correct any errors in location or construction with respect to hazard vulnerability. It is for these reasons that zoning and other ordinances, which manage development in high vulnerability areas, and building codes, which insure that new buildings are built to withstand the damaging forces of hazards, are often the most useful mitigation approaches a city can implement.

Previously, mitigation measures have been the most neglected programs within emergency management. Since the priority to implement mitigation activities is generally low in comparison to the perceived threat, some important mitigation measures take time to implement. Mitigation success can be achieved, however, if accurate information is portrayed through complete hazard identification and impact studies, followed by effective mitigation management. Hazard mitigation is the key to eliminating long-term risk to people and property in Utah from hazards and their effects. Preparedness for all hazards includes response and recovery plans, training, development, management of resources, and the need to mitigate each jurisdictional hazard.

The State Division of Emergency Management and Homeland Security (DESHS) have identified the following hazards to be analyzed by each county. These hazards include avalanche, dam failure, debris flow, drought, earthquake, flood, flash flooding, infestation, landslide, problem soils, summer storm, tornado, urban and rural fires, and winter storm.

This regional/multi-jurisdictional plan evaluates the impacts, risks and vulnerabilities of natural hazards in a jurisdictional area affected by a disaster. The plan supports, provides assistance, identifies and describes mitigation projects for each annex. The suggested actions and plan implementation for local and tribal governments could reduce the impact of future disasters. Only through the coordinated partnership with emergency managers, political entities, public works officials, community planners and other dedicated individuals working to implement this program will it be accomplished.

To develop the mitigation plan, Utah DESHS, based on consultation with the Governor's Office of Planning and Budget, the Utah League of Cities and Towns, and the U.S. Department of Housing and Urban Development, chose to use the planning services of the Utah Association of Governments.

Seven regional Associations of Governments:

1. Bear River Associations of Governments
2. Wasatch Front Associations of Governments / Wasatch Front Regional Council
3. Mountainland Associations of Governments
4. Six County Associations of Governments
5. Southeast Utah Associations of Governments
6. Southwestern / Five County Associations of Governments
7. Uintah Basin Associations of Governments

PURPOSE

To fulfill federal, state, and local hazard mitigation planning responsibilities; to promote pre and post disaster mitigation measures, short/long range strategies that minimize suffering, loss of life, and damage to property resulting from hazardous or potentially hazardous conditions to which citizens and institutions within the state are exposed; and to eliminate or minimize conditions which would have an undesirable impact on our citizens, the economy, environment, and the well-being of the state of Utah. This plan is an aid in enhancing city and state officials, agencies, and public awareness to the threat that hazards have on property and life and what can be done to help prevent or reduce the vulnerability and risk of each Utah jurisdiction.

SCOPE

Utah PDM Planning phase is statewide. The State of Utah will work with all local jurisdictions by means of the seven regional Association of Governments. The *Bear River Association of Governments*, which encompasses all of Northern Utah, including the counties of Box Elder, Cache, and Rich Counties, will have a plan completed by December 31, 2003 to give to the Utah Division of Emergency Services. Future monitoring, evaluating, updating and implementing will

take place as new incidents occur and or every three to five years and will be included in the local mitigation plans as well.

OVERALL GOALS

To coordinate with each participating local government to develop a regional planning process meeting each plan component identified in the FEMA Region VIII Crosswalk document and any additional State planning expectation, both regionally and specifically, as needed, by gathering local input and to also meet the need of reducing risk from natural hazards in Utah, through the implementation of and updating of regional plans.

LOCAL GOALS

These goals form the basis for the development of the PDM Plan and are shown from highest priority, at the top of the list, to those of lesser importance nearer the bottom.

- Protection of life before, during, and after the occurrence of a disaster.
- Protection of emergency response capabilities (critical infrastructure)
- Communication and warning systems
- Emergency medical services and medical facilities
- Critical facilities
- Government continuity
- Protection of developed property, homes and businesses, industry, education opportunities and the cultural fabric of a community, by combining hazard loss reduction with the community's environmental, social, and economic needs.
- Protection of natural resources and the environment, when considering mitigation measures.

Long Term Goals

- Eliminate or reduce the long-term risk to human life and property from identified natural and technologic hazards.
- Aid both the private and public sectors in understanding the risks they may be exposed to and finding mitigation strategies to reduce those risks.
- Avoid risk of exposure to identified hazards.
- Minimize the impacts of those risks when they can not be avoided
- Mitigate the impacts of damage as a result or identified hazards.
- Accomplish mitigation strategies in such a way that negative environmental impacts are minimized.
- Provide a basis for funding of projects outlined as hazard mitigation strategies.
- Establish a regional platform to enable the community to take advantage of shared goals, resources, and the availability of outside resources.

PART II --PLANNING PROCESS

BEAR RIVER DISTRICT PDM PLANNING PROCESS

This mitigation plan is the result of a comprehensive and coordinated planning process. Beyond involvement of the general public, a great deal of the effort focus was on coordinating and getting input from the thirty nine cities, towns and counties located in the Bear River District.

How the Plan was Produced

Professional planning staff at Bear River Association of Governments (BRAG) was responsible for coordinating the planning process and producing the document. The process was overseen and coordinated with BRAG's fifteen member governing board who served as the Hazard Mitigation Steering Committee (see membership lists at the end of this section). In addition a Hazard Mitigation Technical Team was assembled to provide guidance, input and technical assistance to the planning process. This team was primarily comprised of emergency management coordinating staff as well as public works and planning staff representing interested entities in BRAG's three county region.

The first phase of the project was targeted to education outreach and input. BRAG's Hazard Mitigation Steering Committee was informed of the State of Utah's approach to meeting the planning requirements of the Disaster Mitigation Act of 2000 and endorsed the approach as well as providing suggestions on how the plan should be produced. See Appendix C for a full copy of the above article.

Prevention top priority in BRAG disaster plan

By Joe Rowley
Staff writer

How much does it cost to clean up after a flood, earthquake or mudslide? Apparently, way too much.

The Bear River Association of Governments, or BRAG, along with regional and local groups across the nation, is working on a plan that should slow the rapidly rising costs of natural disaster relief. It comes from a federal initiative [illegible]

"It's common sense stuff that hasn't received a concerted effort nationwide."

– Roger Jones
BRAG executive director

[illegible] received a concerted effort nationwide," Jones said.

Some local officials already know about many of the possible hazards that could befall Cache County residents, Gilbert said. Logan and other cities have put into place emergency response plans, which by definition anticipate potential situations.

"We're really quite poised to go for emergency response," Gilbert said. The [illegible] mitigation plan takes it [illegible] that, though [illegible] initiative applies to [illegible]. To make it [illegible] nance accepting the plan to comply with the FEMA requirements. The plan is due to the state by November, Jones said.

BRAG recently asked mayors in the Bear River area to inventory any problem areas in their communities.

"Who knows what's going on in the cities better than the people who live there?" Gilbert said.

Gilbert will then compile all of the information gathered from the individual cities and add it to information from the U.S. Geological Survey, Sheriffs' offices and Utah

March 30, 2003- Logan Herald Journal Newpaper Article

On September 12, 2003 the first meeting of BRAG's Hazard Mitigation Technical Team convened to introduce the requirements of the DMA2000, to discuss solutions and respond to any questions or concerns. At this meeting it was decided that the community officials representing the 39 different municipalities in the region should be informed early about the process and their responsibility and given a chance to provide input. It was decided that since most of the cities are represented by volunteer part-time elected officials any information would need to be concise, simple and targeted to be effective.

At this meeting it was decided that a one page "fact sheet" should be produced and disseminated to elected officials and other interested parties (See Appendix C). In addition it was suggested that a short survey form be produced and mailed along with the fact sheet and cover letter to the chief elected official of each jurisdiction (See Appendix A for the results). Agreement was reached that the survey instrument needed to be non-technical and be short enough to be completed in a half hour or less. Given the time constraints for most of the volunteer elected officials, survey response rates will be reduced for lengthy technical surveys.

It was also decided rather than set ongoing meetings for the Hazard Mitigation Technical Team, we should communicate on an "as needed" basis and use phone, email and postal mail to keep connected. Arrangements were made to obtain all hazard mapping, ordinances, reports, plans and documents related to natural hazard identification, mitigation or response.

On October 12, 2002 BRAG staff met with the Cache County Mayor's Association at one of their regular meetings. Elected officials from all of the incorporated municipalities in Cache County were present as well as county officials. The purpose of the meeting was to introduce them to the requirements of DMA2000 and describe the BRAG region's approach and process. Elected officials in attendance were given a fact sheet and survey and encouraged to complete it soon. The need for local input was emphasized in terms of history of hazard events, identification of problems and development of mitigation strategies. In addition, the cities were informed of their role in adopting the plan when complete (See Appendix C).

Later in October 2002 BRAG staff met with the Box Elder Council of Governments. This meeting had a focus on homeland security and natural hazard mitigation planning. A good representation of the county's elected officials were in attendance as well as emergency management personnel. Topics of discussion were similar to the Cache County meeting (See Appendix C).

All but two of the chief elected officials for Rich County, sit on the Natural Hazard Mitigation Steering Committee. Coordination with the others was achieved on an individual basis.

Next, a great deal of time was spent collecting information related to natural hazards from local jurisdictions and other sources. This effort was guided by the surveys completed by most of the jurisdictions. Many hours were spent in the special collections section of Utah State University's library collecting local reports, studies, thesis and dissertations related to natural hazards in the tri-county area. A rather exhaustive inventory of papers and reports documenting past natural hazard problems or events was compiled.

At the same time a natural hazard GIS database was being developed. Local sources of data were investigated and many GIS data layers were collected (almost 4 gigabytes). Most of this data already existed and was clipped and incorporated into the database. Some data was not in digital form and was deemed so essential to the quality of the planning effort that BRAG digitized the data to use in the GIS. For example, the FEMA flood plain maps were not in GIS digital format. Flooding threat is such a significant issue in terms of ongoing, predictable risk it was decided to "heads up" digitize these maps by "rubber sheeting" scanned copies. This effort took a considerable amount of time, but in our view was necessary to a quality, complete analysis of hazards.

The next phase of the process was to analyze the data to identify hazard conflicts as it relates to developed areas and to complete the risk assessment part of the plan. Meeting the FEMA requirements in this regard proved challenging with the data we had available. In terms of a GIS parcel level data source with property values included, the database is incomplete for the three county areas. We had to develop our own approach given the data we had available. We spent a

great deal of time developing, testing and refining an approach that produced the output we required, given the information available (See discussion on "Hazard Analysis Process in Part IV).

All along in this process various local elected officials, city personnel and emergency management officials were kept in touch with in terms of process updates, requests for verification of analysis results and confirmation of data accuracy and relevancy that may be from a statewide source in their local areas. Also as clarification on the Hazard Mitigation Planning Process came from FEMA in the form of a series of "How-to Guides" became available. These documents were ordered and disseminated to emergency management contacts so we all had a common understanding of the process and goals.

At a November 8th, 2003 "Citizen Planner" training workshop attended by over **forty local Planning Commissioners and other elected and appointed community officials**, a presentation was made on hazard mitigation planning and the draft plan material was made available to attendees for review and comment. Attendees were also directed to the plan's Internet web site for the full content of the plan (http://www.brag.dst.ut.us/develop-hazard%20mit.htm).

In November 2003 the final draft version of the plan was promulgated for review and comment. Again, elected officials were asked to help identify and describe any potential hazard mitigation projects they would like to see included in the plan. **The planning process, general regional data, risk assessment sections along with their jurisdiction's county annex was mailed in hardcopy form to each mayor and county commissioner in the three county region.** Again, elected officials were directed to the BRAG website if they wished to see the full version of the plan. Also, an advertisement was placed in all of the newspapers of general circulation in the three county area making the draft plan available for public review and comment either at the BRAG office or on the Internet (See Appendix C).

In addition, individual meetings were held with most of the emergency managers in the region to discuss the draft plan and gain comments and input. Besides the emergency managers, a draft version was mailed to the Cache Countywide Planning Office, Cache Metropolitan Transportation Organization, Bear River Health Department, Cache County Chapter of the American Red Cross, Bear Lake Regional Commission and the Utah Association of Conservation Districts for comment.

Regional Hazard Mitigation Steering Committee

Commissioner Clark Davis
Box Elder County

Mayor Lou Ann Christensen
Brigham City

Commissioner Suzanne R. Rees
Box Elder County

Commissioner Scott Hansen
Box Elder County

Mayor H. Paul Orme
Honeyville City

County Executive M. Lynn Lemon
Cache County

Councilmember Darrel L. Gibbons
Cache County

Mayor Alma Leonhardt
Providence City

Mayor Doug Thompson
Logan City

Councilmember Cory Yeates
Cache County

Commissioner Norman Weston
Rich County

Commissioner Bill Cox
Rich County

Mayor Mckay Willis
Laketown

Mayor Craig Showalter
Woodruff Town

Commissioner Thomas J. Weston
Rich County

Regional Hazard Mitigation Technical Team

Bruce Leonard
Public Works Director
Brigham City Corp. (Box Elder)

Jim Buchanan
Emergency Management Dir.
Brigham City Corp. (Box Elder)

Roger Jones
Executive Director
BRAG

Paul Fulgham
Emergency Management Dir.
Tremonton City (Box Elder)

Stephen W. Hodges
Police Chief
Tremonton City (Box Elder)

Public Works Dir.
Logan City Corp. (Cache County)

Scott Douglas
Emergency Management Dir.
Logan City Corp. (Cache County)

Thad Erickson
Water Advisory Board
Cache County

Denton Beecher
Emergency Management Dir.
Box Elder County

Darrin Henry
Emergency Management Dir.
Cache County Corp.

Mark Teuscher
Countywide Planner
Cache County Corp.

Jim Gass
City Manager
Smithfield City (Cache County)

Kelly Pitcher
Fire Chief
Cache County Corp.

GIS Coordinator
Logan City Corp. (Cache County)

Kevin Maughan
Emergency Management Dir.
Hyrum City Corp. (Cache County)

PART III: GENERAL REGIONAL DATA

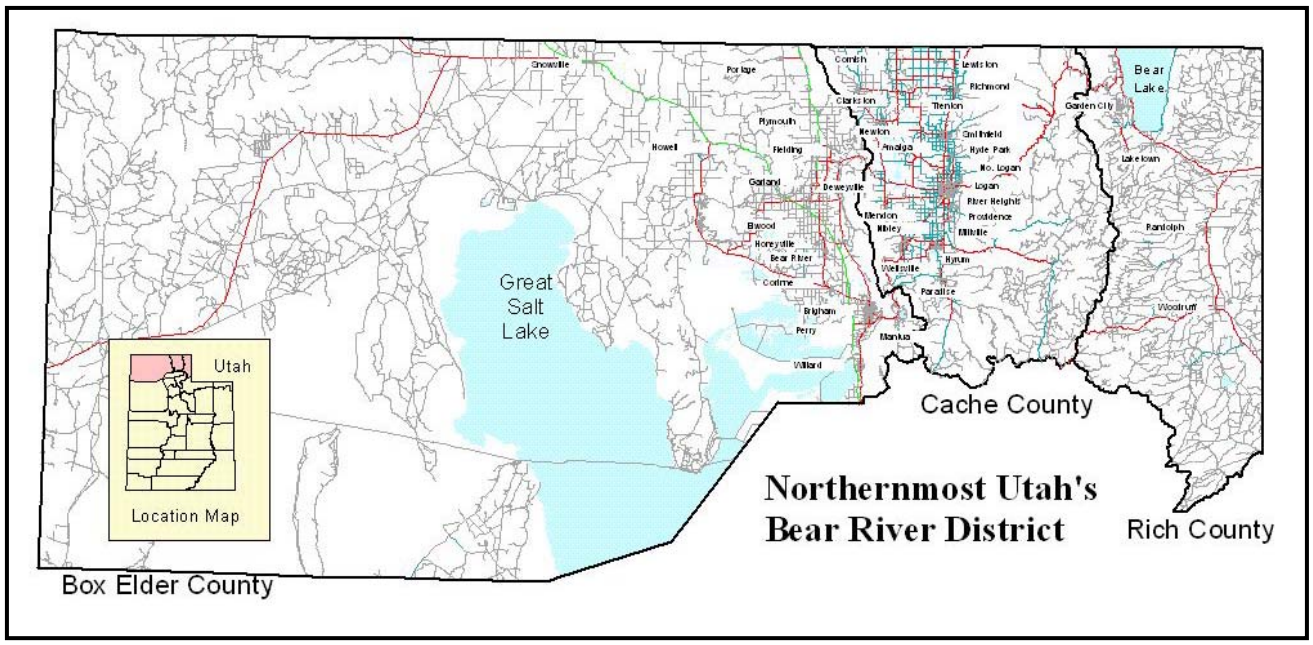
GEOGRAPHIC AND PHYSIOGRAPHIC BACKGROUND

Bear River Association of Governments is composed of Box Elder, Cache and Rich counties located in the far northern territory of Utah. This district is spread over 7,900 square miles.

Box Elder County comprises 5594 square miles and is bordered on the east by the Wellsville Mountains and Cache County, Weber County as well as the Great Salt Lake and the salt flats on the south, Nevada on the west, and Idaho to the North. Several small ranching communities occupy this area of the basin and range province. The eastern geography is mainly rolling ranch land and small rural communities. The largest fresh water feature is the Bear River that flows from Cache County into the Great Salt Lake.

Cache County covers approximately 1174 square miles and is bordered by the Wellsville Mountains on the west and the Bear River Range on the east. The surface water features include Little Bear, Blacksmith Fork and the Logan River in the south and Bear and Cub River in the north. The "bench" is a elongated plateau that surrounds the valley from the sea- shores of ancient Lake Bonneville.

Rich County comprises 1022 square miles and is bordered on the west and south by the Bear River and Monte Cristo Ranges and on the east by the rolling desert highlands of southwestern Wyoming. To the north lie's more uplands and the mountain ranges of southeastern Idaho. Bear Lake is the largest geographical feature in the county that extends 20 miles in length. Forty-four percent of Rich County is administered by federal and state agencies.



DEMOGRAPHICS

The total population for the Bear River District (Box Elder, Cache and Rich Counties) grew over 29% from 1990 to 2002 for a total of 139,693 persons in the three county region (Census Bureau estimates). This growth rate represents an 8% increase from the previous decade (See Table III-1).

Cache County saw the largest increase of the three counties with an expansion of over 30% for the decade of the 1990's (21,208 persons added for a total of 91,391 persons). This represented a 7% increase over the previous decade but not as high as the period from 1970-80 which recorded a 35% growth rate. The fastest growing incorporated city in Cache County was Nibley City with an overall growth rate of over 75% for the 1990s. During the same time, North Logan City also grew at a rate significantly higher than other Cache County towns with at a rate of nearly 64%. Logan City grew at a relatively modest rate of just over 30%. In terms of the actual numbers of persons proportionally added to the overall county growth during the 1990s, Logan was by far the largest contributor by adding nearly 10,000 persons. In fact, this number is probably lower than it should be due to the likely significant number of Utah State University students that did not complete Census 2000 forms and thus were not included in the Logan City/Cache County count. Logan City's 2000 population was determined to be 42,670.

The more urbanized portions of Cache County are part of a Metropolitan Planning Organization (MPO). This area comprises the Logan Urbanized Area (LUA). In addition, in 2003 Logan City was designated the central city in a Metropolitan Statistical Area that encompasses all of Cache County and Franklin County Idaho.

Box Elder County's overall growth rate for the decade of the '90s was 17.2%. The year 2002 total population count was 44,032 (actual population added was 7,547 persons). While lower than the state average, this figure represents nearly a doubling in the county's growth rate from the decade of the 1980's. Due to its size (in terms of actual increase in the 2000 Census) Brigham City recorded the largest increase by adding 1,767 persons. However, this still only represents a rather modest 11% overall increase for Brigham City. Perry City, Brigham's neighboring community to the south added almost as many persons to their population as Brigham did during the 1990's. The difference is that Perry City started the decade with only 1,211 people and by the time the decade ended they had nearly doubled their population to 2,383. The 96% growth rate is not only the highest growth rate in the County and the Bear River District, but also one of the highest in the state. The only other communities in Box Elder County that showed any sort of significant growth rate during the 1990's were Tremonton and Willard City with 31.1% and 25.6% respectively. Most the other communities in the county saw stable or minor increases in their population with the exception of four towns that actually declined in population during the 1990's.

Rich County's overall population increase for the 1990's was 13.7% for a year 2002 total of 1,966. While modest by comparison to district or state growth rates, Rich County's 1990's population growth was significantly higher then the previous decade which saw a negative growth rate of nearly 18%. Garden City marked the highest growth rate in the county for the 1990's by adding 164 of the total 236 persons for the entire county. This represents a 85%

growth rate for Garden City. With the exception of Woodruff Town which grew by 59 persons or nearly 44%, the other two communities in Rich County kept nearly level or decrease population slightly. Population numbers generated by the census every ten years do not fully describe the demographic situation with regard to Garden City and some unincorporated portions of the county around Bear Lake. In recent years, Garden City and areas on the east shore of Bear Lake have seen significant growth and development in the form of part-time "summer home" dwelling units. The people that occupy these homes generally do not live in them for more than nine months required by the Census Bureau to be considered resident and usually complete the Census form at their home address. This presents a unique challenge for these jurisdictions that must provide infrastructure and services to a population that does not show up on any of the Census counts. **(See the "Population Density Map" in the map section of each county's annex)**

Table III-1 Population Estimates for the Bear River District

Jurisdiction Name	2002 Population	Annual Average Rate of Change 1990-2000	2020 Projected Population
BOX ELDER COUNTY	44,032	1.60%	63,391
Bear River City	778	.69%	1,112
Brigham City	17,389	1.08%	25,821
Corinne City	651	-.29%	921
Deweyville Town	296	-1.34%	412
Elwood Town	675	1.66%	1,005
Fielding Town	450	.60%	664
Garland City	1,970	1.73%	2,881
Honeyville City	1,265	.88%	1,800
Howell Town	232	-.70%	328
Mantua Town	802	1.75%	1,173
Perry City	2,740	7.00%	3,534
Plymouth Town	359	2.08%	486
Portage Town	259	1.66%	381
Snowville Town	177	-3.43%	262
Tremonton City	5,996	2.79%	8,293
Willard City	1,639	2.30%	2,417
Unincorporated	8,354	1.31%	11,898
CACHE COUNTY	93,695	2.68%	137,966
Amalga Town	427	1.55%	587
Clarkston Town	685	.65%	826
Cornish Town	259	2.37%	259
Hyde Park City	2,938	3.04%	3,787
Hyrum City	6,303	2.72%	8,438
Lewiston City	1,862	2.05%	2,457
Logan City	42,922	2.68%	59,587
Mendon City	938	2.76%	1,782
Millville City	1,501	2.29%	1,973
Newton Town	706	.59%	1,045

Table III-1 Population Estimates for the Bear River District			
Jurisdiction Name	**2002 Population**	**Annual Average Rate of Change 1990-2000**	**2020 Projected Population**
Nibley City	2,210	5.77%	4,235
North Logan City	6,745	5.04%	9,043
Paradise Town	753	3.07%	1,093
Providence City	4,845	2.73%	13,512
Richmond City	2,043	.48%	2,592
River Heights City	1,490	1.62%	1,657
Smithfield City	7,604	2.69%	12,601
Trenton Town	450	-.33%	595
Wellsville City	2,724	2.18%	3,574
Unincorporated	6,290	1.81%	8,323
RICH COUNTY	1,966	1.29%	2,351
Garden City	365	6.34%	428
Laketown	182	-3.23%	225
Randolph City	471	-.10%	579
Woodruff Town	190	3.69%	233
Unincorporated	758	1.32%	886
Source: Bear River Association of Governments projections based on GOPB county totals. Governors Office of Planning and Budget.			

ECONOMIC PROFILE

Box Elder County has 3,541,541 acres of land and a population density of 7.5 persons per square mile. From 1990 to 2000, the county grew at an average rate of 1.6 percent per year, slower than the state average of 2.7 percent. Manufacturing accounts for almost half of the employment in the county; the county also leads the state in many measures of agricultural productivity. Box Elder County experienced a 3.1 percent decrease in the civilian labor force from 1999 to 2000. In addition, the unemployment rate in the county in 2000 was 4.5 percent, significantly higher than the state rate of 3.2 percent.

The median family and household incomes are slightly lower than the state averages. The changes in per capita income reflect the economic downturn currently experienced by the county. In 1990, Box Elder County's per capita income was 1.5 percent higher than the state average, but by 1999 it had dropped to 93 percent of the state per capita income.

PER CAPITA INCOME COMPARISON*

	1990	**1999**
Box Elder County	$15,218	$21,554
State of Utah	$14,996	$23,276

*Demographic & Economic Analysis, GOPD, 2002

Another indicator of the number of families living at very low and low-income levels is the number of school age children enrolled in the free/reduced lunch program. In the 2001-2002 school year, Box Elder School District had a total of 10,763 students; 3,527 were enrolled in the

free/reduced lunch program. This statistic would indicate that 33 percent of the children enrolled in school belong to very low or low-income families.

Housing stock and property values vary widely throughout the county. Data from the 2000 Census shows that the median age of homes in the county is 33 years, indicating a somewhat aging housing stock. There are a total of 6,882 homes that were built prior to 1979. The median value of owner-occupied housing reported by the 2000 Census was $118,900. It should be noted that there has been a significant increase in the median value of existing owner-occupied housing from 1990 to 2000. The average countywide increase in property values was 83 percent, but some areas experienced over a 100 percent increase in value. Data from the Utah Association of Realtors (2002) confirm that home prices in the county have risen dramatically. The average sales price of homes in the county increased from $65,244 in 1995 to $112,370 in 2002, an increase of 72 percent in a seven year period. The data also demonstrate wide variation in prices throughout the county.

Cache County covers approximately 1,165 square miles, and there are 19 incorporated communities within the county. The Logan Urbanized Area includes Smithfield, Hyde Park, North Logan, Logan, River Heights, Providence, Millville, Nibley, Hyrum and Wellsville. The area has grown tremendously over the past decade; the 2000 Census indicated a total population of 91,897, an increase of 30 percent from the previous Census. The majority of these residents live in Logan City, which has a population of 42,670. Logan City is home to Utah State University and Bridgerland Applied Technology College; as a result, the educational level of Cache County residents is quite high. The high number of students also impacts housing in Logan City; the area east of Logan's Main Street contains a large number of rental units with students typically living at low incomes (Bear River District Overall Economic Development Plan, (OEDP), 1999). Cache Metropolitan Planning Office (2002) estimates indicate that only 50% of the 16,485 single-family dwelling units in Logan City are owner-occupied; there are an additional 7,020 multi-family rental units.

Cache County has one of the state's most diverse economies and lowest unemployment rates. In 2001, the county's unemployment rate was 2.9 percent, compared to Utah's rate of 4.4 percent. However, the effect of the high student population and the low unemployment rate creates keen competition for jobs, with many "residents looking for higher paying positions while they work at lower paying jobs" (OEDP, 1999) This is demonstrated by income measures that are noticeably lower than the state averages, including family income, household income, per capita income, and persons living in poverty. Tracking the changes in these measures also indicates that the gap is increasing. For instance, Cache County's 1990 per capita income was 88 percent of the state average; by 2000 it had dropped to 82 percent.

PER CAPITA INCOME COMPARISON*

	1990	1999
Cache County	$13,259	$19,177
State of Utah	$14,996	$23,276

*Demographic & Economic Analysis, GOPD, 2002

In the 2001-2002 school year, Logan School District had a total of 5,875 students; 41 percent (2,388) were enrolled in the free/reduced lunch program. Cache County School District had a

total of 13,103 students, and 26 percent (3,439) participated in the program. This is a countywide average of 31 percent of the total school age population whose families' incomes are sufficiently low enough to qualify them for the free or reduced lunch program.

Housing stock and property values vary widely throughout the county. Census data show a wide range in the median value of homes as reported by the owners, from $97,700 in Clarkston to $168,300 in Avon. In 1994, BRAG conducted a Comprehensive Housing Affordability Survey (CHAS) which found that 23.7 percent of all homes in Cache County were built prior to 1939. Census data show that the median age of homes in Cache Valley is 27 years, demonstrating an aging housing stock that will continue to require rehabilitation and remodeling for energy efficiency.

PER CAPITA INCOME COMPARISON*

	1990	1999
Rich County	$12,369	$16,958
State of Utah	$14,996	$23,276

*Demographic & Economic Analysis, GOPD, 2002

In 2000, Rich County had a population of 1,961 people; it is the third smallest county in the state. The county has 658,039 acres of land; 523,744 acres in farms, of which 60 percent are full-time farms. Three-quarters of Rich County's land is used for grazing. Total nonagricultural employment in 2000 was 559 employees. Bear Lake's recreational uses have also provided employment in real estate and tourism-related trades.

The average family and household size are both slightly smaller than the state averages. The median age in 2000 was 34.3 years, compared to the state median of 27.1 years. Data from the 2000 Census showed that 14.1 percent of the population was over age 65. The Garden City/Laketown area's median age in 2000 was 40.9 years, a decline from 30 years in 1990 (BRAG Consolidated Plan, 2002).

It is interesting to note that the most significant growth in the Garden City/Laketown area has been in the unincorporated areas outside of the city boundaries, where many of the Bear Lake recreational developments are located. In the past ten years, the population in the unincorporated area around Garden City/Laketown has increased 90 percent, from 181 to 334 persons. The number of households also increased, from 56 to 127. Garden City experienced similar growth from 1990 to 2000, both the total population and the number of households increased 85 percent. However, the population and number of households decreased in Laketown, due in part to culinary water problems and the availability of land (BRAG Consolidated Plan, 2002).

Rich County has the lowest wage rate among Utah's 29 counties. In 2000, the average annual wage was $15,564; 54 percent of the state average of $28,812 (BRAG Consolidated Plan, 2002). Other income measures show similar results; median family, household, and per capita income are all significantly lower than state averages. In 1999, 11.3 percent of the county population lived below the poverty rate, as compared to a statewide rate of 9.2 percent. Unemployment rates in the county are also slightly higher than the state average, 3.7 percent versus 3.2 percent.

Tracking per capita income changes over the past ten years indicates that Rich County has traditionally lagged behind the state average, and the gap has continued to grow. The per capita income decreased from 82 percent of the state's average in 1990 to 73 percent in 2000.

Data from the Utah Department of Workforce Services estimate that while the Randolph/Woodruff area saw a decrease of 21 employees (11%) from 1990 to 2001, the Garden City/Laketown area added 223 employees (137%) during the same time period. However, 60 percent of the 2001 nonagricultural employment in the Garden City/Laketown area was in the service and trade industries. The service sector saw the greatest increase in employment from 1990 to 2001, adding an additional 112 employees. Employees in the service industry have an estimated average annual income of $10,488; 36 percent of the state's average income. Trade employees have an estimated average annual wage slightly lower than the service industry at $10,428. Examining the data demonstrates that the increase in nonagricultural employment has created households who are in the greatest need for affordable housing. The extremely low wages in Rich County, particularly in the expanding trade and service sectors, imply a strong need for affordable housing (BRAG Consolidated Plan, 2002).

Further proof of the economic difficulties Rich County residents are facing is found in the number of school-age children enrolled in the free/reduced lunch program. In the 2001-2002 school year, Rich County School District had 473 students; 341 of them were enrolled in the free/reduced lunch program. This is 72 percent of the total student body; a number that strongly demonstrates the number of very-low and low-income families in the county who are require suitable affordable housing.

CLIMATE

Elevations in the region vary from 4,200 to over 10,000 feet. Annual precipitation ranges from 9 inches to over 40 inches. The high mountain valleys experience long cold winters and short cool summers.

Rich County is regarded as having severe winters. An early settler described the climate as "nine months of winter and three months of late fall". Woodruff holds the statewide records for the lowest yearly temperatures (-50 F).

GEOLOGY

This area is comprised of Box Elder, Cache and Rich counties and is home to the Wellsville Mountain Range and the Bear River Range. Notable physiographic features of the region include: the Crawford Mountain, Bear Lake Plateau, Goose Creek/Raft River Mountains, Curlew Valley, Hansel Mountains-Blue Springs Hills, Great Salt Lake Desert, Lakeside Section and the Clarkston Mountain/Junction Hills (Stokes, 1988).

The Wellsville Range is east of Brigham City and is known for its long, upward-faulted ridge of Precambrian metamorphic rocks covered by Paleozoic aged sedimentary rocks.

The Paleozoic section of the rock sequence is quite consistent throughout this area with sandstone on bottom, shale, and finally limestone or dolomite. Most of the rocks are of marine or near shore deposits from the ancient Lake Bonneville. The Wasatch Fault is evident in the

western edge of the Wellsville Mountain Range with the eastern portion lifted thousands of feet than the western edge. The Eastern portion is comprised of mainly Pennsylvanian and Permian aged rocks. Cache Valley is a dropped portion between the East Cache Fault and the Bear River Range. The Cache Valley was once an arm of Lake Bonneville. Logan Canyon is made up of Paleozoic ant Tertiary rocks with the same sequence as mentioned above. The Bear River Range is situated on the east of the western extent of the Middle Rocky Mountain Physiographic Province. The Overthrust Belt Geologic Province is what uplifted these mountains about 50 million years ago. The Intermountain Seismic Belt is a result of the Overthrust Belt. "The Intermountain Seismic Belt forms a boundary between the Basin and Range and the Middle Rocky Mountain Physiographic provinces" (Mabey, 1999). This zone because of the series of faults is the reason why we are able to see the older Paleozoic and Mesozoic rocks above the younger Tertiary and Quaternary aged sedimentary rocks. The ranges from the Bear River Range to the east are part of the Great Basin Physiographic province, which consists of mainly Quaternary age surface deposits such as alluvium, terrace deposits, sand dunes, and lakebed sediments.

The soil morphology in this region is characterized by deep to very deep well drained soils. Down cutting from the Bear River and its tributaries have resulted in massive erosion. Soils on old lake bottoms in the middle of Cache and Salt Lake valleys are nearly level, moderately well to poorly drained, very deep, and derived from lacustrine and alluvial deposits (Department of Landscape Architecture and Environmental Planning USU, 2001).

NATIONAL FLOOD INSURANCE PROGRAM PARTICIPATION

Table III-2: National Flood Insurance Program (NFIP)				
	Community Name * Unincorporated areas only	**CID**	**Date of Entry** (Emergency Program (E) or Regular Program (R))	**Current Effective Map** (No Special Flood Hazard Area (NSFHA), all zone (C))
Box Elder County	Box Elder County *	490005#	09/01/87 (R)	09/01/87 (L)
	Brigham City, City of	490006#	08/17/81 (R)	08/17/81
	Corinne, City of	490197#	07/15/80 (R)	07/15/80 (M)
	Honeyville, City of	490008#	07/29/80 (R)	07/29/80 (M)
	Mantua, Town of	490009#	07/08/80 (R)	07/08/80 (M)
	Perry City, City of	490010#	05/20/80 (R)	05/20/80 (M)
	Willard, City of	490011A	07/01/87 (R)	07/01/87 (L)
Cache County	Cache County*	490012#	02/01/87 (R)	02/01/87 (L)
	Clarkston, Town of	490014#	08/19/80 (R)	08/19/80 (M)
	Hyde Park, Town of	490016#	07/29/80 (R)	07/29/80 (M)
	Hyrum, City of	490017#	04/08/80 (R)	04/08/80 (M)
	Lewiston, City of	490018#	07/29/80 (R)	07/29/80 (M)
	Logan, City of	490019#	09/28/84 (R)	09/28/84
	Mendon, City of	490020 #	07/22/80 (R)	07/22/80 (M)
	Millville, Town of	490021	03/13/85	10/22/76
	Newton, Town of	490022#	07/22/80 (R)	07/2280 (M)
	North Logan, City of	490024#	03/18/86 (R)	03/18/86 (M)
	Providence, City of	490226	02/02/84 (R)	(NSFHA)
	Richmond, City of	490027#	08/12/80 (R)	08/12/80 (M)
	Smithfield, City of	490029#	03/18/86 (R)	03/18/86 (M)
	Wellsville, City of	490031#	07/29/80 (R)	07/29/80 (M)
Rich County	Laketown, Town of	490099	07/15/85 (R)	(NSFHA)
	Woodruff, Town of	490101#	07/22/80 (R)	07/22/80 (M)
Source: National Flood Insurance Program (FEMA)				

BUILDING CODE EFFECTIVENESS GRADING REPORTS (BCEGS)

The Building Code Effectiveness Grading Report was implemented in 1995 to evaluate current building codes in a particular community and determine how well the community enforces its building codes. This program assigns each municipality a grade of 1 to 10 with one showing excellent commitment to building code enforcement. The concept of the Building Code Effectiveness Grading Reports is that communities with effective, well-enforced building codes should sustain less damage in the event of a natural disaster, and insurance rates can be adjusted accordingly.

Table III-3 BCEGS Scores for the Bear River District

Jurisdiction Name	Score		Date
	Personal Lines	Commercial Lines	
Box Elder County	4	4	2001
Brigham City	3	3	2001
Tremonton	5	5	2000
Willard	5	5	1998
Cache County	3	3	2001
Hyde Park	3	3	2001
Logan	3	3	1999
No. Logan	3	3	1999
Smithfield	4	4	2000
Garden City	unknown	7	1998

Jurisdictions not listed are unclassified. BCEGS classifies a jurisdictions commitment to building code enforcement with a rating of 1 being "exemplary".

PART IV: RISK ASSESSMENT

HAZARD IDENTIFICATION PROCESS

Hazards were identified and evaluated for inclusion in this plan based on historical review of past events, synthesis of existing reports, data and hazard mapping analysis, and finally input from local level emergency management personnel and other community officials. Consideration for inclusion was based on the likelihood of a hazard's occurrence, location of the occurrence and the potential impact of the event in terms of it effect on human life and property (See Table IV-1).

Surveys were sent to the chief elected official for all jurisdictions in the Bear River District. Among other questions, the survey instrument requested local input on hazard identification, completed and needing hazard mitigation projects, participation in the National Flood Insurance Program and the existence of hazard maps and ordinance for their locality (See Appendix A).

Table IV-1: Hazard Identification & Justification for Inclusion

Hazard	How Identified	Why Identified
Earthquake	Local Official Surveys Review of Local Emergency Operations Plans Input from City and County Emergency Operations Managers United States Geological Survey Utah Geological Survey	Bear River District has experienced both the largest (1934 Hansel Valley 6.54 Magnitude) and the most damaging (1962 Richmond 5.7 Magnitude) in the state's modern history (cost $1 Million in 1962 dollars). Numerous faults throughout region Located in the Intermountain Fault Zone.
Flood	Local Official Surveys Review of Local Emergency Operations Plans JUB Study of Cache Canals Input from City and County Emergency Operations Managers Utah Geological Survey Flood Insurance Study Army Corps of Engineers	Several previous incidents have caused severe damage and loss of life Many of the rivers and streams are located near neighborhoods Many neighborhoods are located on floodplains, alluvial fans Exposure to risks are increasing
Landslide	Local Official Surveys Review of Local Emergency Operations Plans Input from City and County Emergency Operations Managers Utah Geological Survey	Historically problematic Can be deadly
Wildfire	Local Official Surveys Input from City and County Emergency Operations Managers Utah Forestry, Fire and State Lands	Historically Problematic Associated with flooding, earthquake
Dam Failure	Local Official Surveys Review of Local Emergency Operations Plans Input from City and County Emergency Operations Managers Utah Division of Water Rights, Dam Safety Section	Can cause serious damage to life and property and have subsequent effects such as flooding, fire, debris flow, etc.

Table IV-1: Hazard Identification & Justification for Inclusion		
Hazard	**How Identified**	**Why Identified**
Drought, Infestation & Severe Weather	Local Official Surveys Review of Local Emergency Operations Plans Input from City and County Emergency Operations Managers Utah State University Agricultural Extension	Potential significant effect one of the largest sectors of the region's economy. Previous experiences

HAZARD DEFINITIONS

The following is a description of each of the hazards evaluated in the Bear River District Pre-disaster Mitigation Plan. These definitions, with minor modifications, were developed by DESHS and used by permission in this plan.

Flooding

Flooding is a temporary overflow of water onto lands not normally inundated by water producing measurable property damage or forcing evacuation of people and vital resources. Floods frequently cause loss of life; property damage and destruction; damage and disruption of communications, transportation, electric service, and community services; crop and livestock damage and loss, and interruption of business. Floods also increase the likelihood of hazard such as transportation accidents, contamination of water supplies, and health risk increase after a flooding event.

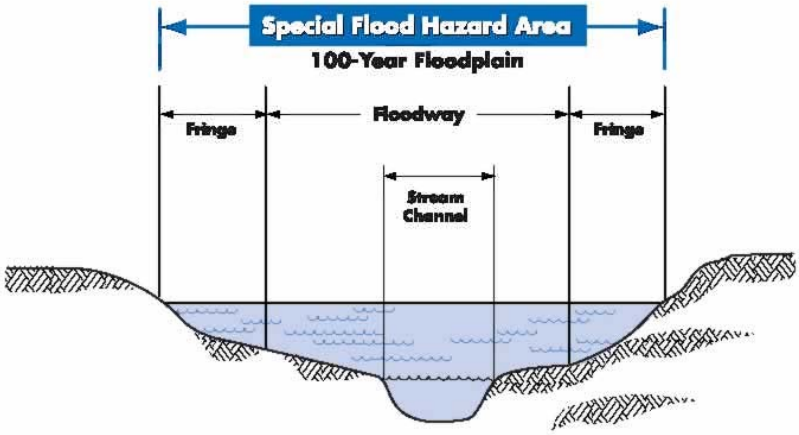
Several factors determine the severity of floods including rainfall intensity, duration and rapid snowmelt. A large amount of rainfall over a short time span can result in flash flood conditions. Small amounts of rain can also result in flooding at locations where the soil has been previously saturated or if rain concentrates in an area having, impermeable surfaces such as large parking lots, paved roadways, or post burned areas with hydrophobic soils. Topography and ground cover are also contributing factors for floods. Water runoff is greater in areas with steep slopes and little or no vegetative ground cover.

Frequency of inundation depends on the climate, soil, and channel slope. In regions where substantial precipitation occurs during a particular season or in regions where annual flooding is due to spring melting of winter snow pack, areas at risk may be inundated nearly every year.

Conditions which my exacerbate floods include: steeply sloped watersheds, constrictions, obstructions, debris contamination, soil saturation and velocity.

Explanation of Common Flood Terms

FIRM: Flood Insurance Rate Map



100-year flood: Applies to an area that has a 1 percent chance, on average, of flooding in any given year. However, a 100-year flood could occur two years in a row, or once every 10 years. The 100 year-flood is also referred to as the base flood.

Base Flood: Is the standard that has been adopted for the NFIP. It is a national standard that represents a compromise between minor floods and the greatest flood likely to occur in a given area and provides a useful benchmark.

Base Flood Elevation (BFE): As shown on the FIRM, is the elevation of the water surface resulting from a flood that has a 1% chance of occurring in any given year. The BFE is the height of the base flood, usually in feet, in relation to the National Geodetic Vertical Datum (NGVD) or 1929, the North American Vertical Datum (NAVD) of 1988, or other datum referenced in the FIS report.

Special Flood Hazard Area (SFHA): Is the shaded area on a FIRM that identifies an area that has a 1% chance of being flooded in any given year (100-year floodplain).

Floodway: Is the stream channel and that portion of the adjacent floodplain that must remain open to permit passage of the base flood without raising that water surface elevation by more than one foot.

Earthquakes

An earthquake is the abrupt shaking of the earth caused by the sudden breaking of rocks when they can no longer withstand the stresses, which build up deep beneath the earth's surface. The rocks tend to rupture along weak zones referred to as faults. When rocks break they produce seismic waves that are transmitted through the rock outward producing ground shaking. Earthquakes are unique multi-hazard events, with the potential to cause huge amounts of damage and loss. Secondary effects of a sudden release of seismic energy (earthquake) include: ground shaking, surface fault rupture, liquefaction, tectonic subsidence, slope failure, and various types of flooding.

The Intermountain Seismic Belt

The Intermountain Seismic Belt (ISB), which the Bear River Region is part of, is a zone of pronounced earthquake activity up to 120 miles wide extending in a north south direction 800 miles from Montana to northern Arizona. The Utah portion of the ISB trends from the Easter Box Elder and Cache County area south through the center of the state, along the Wasatch Front, and the southwest through Richfield and Cedar City concluding in St. George. "The zone generally coincides with the boundary between the Basin and Range physiographic province to the west and the Middle Rocky Mountains and Colorado Plateau physiographic provinces to the east" (Eldredge 6).

Secondary Earthquake Threats

The major secondary effects of earthquakes include: ground shaking, surface fault rupture, liquefaction, tectonic subsidence, avalanches, rock fall, slope failure, and various types of flooding. Other sections discuss landslides, and flooding therefore they will not be discussed under secondary effects of earthquakes yet importance needs to be given to the fact that earthquakes can increase the likelihood of flooding and landslides.

Ground Shaking

Ground shaking causes the most impact during an earthquake because it affects large areas and is the origin of many secondary effects associated with earthquakes. Ground shaking, which generally lasts 10 to 30 seconds in large earthquakes, is caused by the passage of seismic waves generated by earthquakes. Earthquake waves vary in both frequency and amplitude. High frequency low amplitude waves cause more damage to short stiff structures, were as low frequency high amplitude waves have a greater effect on tall (high-rise) structures. Ground shaking is measured using Peak Ground Acceleration (PGA). The PGA measures the rate in change of motion relative to the established rate of acceleration do to gravity.

Local geologic conditions such as depth of sediment and sediment make up, affect earthquake waves. Deep valley sediments increase the frequency of seismic waves relative to bedrock. In general, ground shaking increases with increased thickness of sediments" (Eldredge 8).

Surface Fault Rupture

During a large earthquake fault movement may propagate along a fault plain to the surface, resulting in surface rupture along the fault plain. Most faults in the Bear River District are normal (mountain building) faults with regards to movement, meaning the footwall of the fault moves upward and the hanging wall moves in a down direction. Thus faulting is on a vertical plain, which results in the formation of large fault scarps. In historic time surface fault rupture has only occurred once in Utah; the 1934 Hansel Valley earthquake in Box Elder County with a magnitude 6.6 produced 1.6 feet of vertical offset.

Surface fault rupture presents several hazards, anything built on top of the fault or crossing the fault has a high potential of being destroyed in the event of displacement. Foundations will be

cracked, buildings torn apart, damage to roads, utility lines, pipelines, or any other utility line crossing the fault. It is almost impossible to design anything within reasonable cost parameters to with stand an estimated displacement of 16 to 20 feet.

Surface fault rupture doesn't occur on a single distinct plain; instead it occurs over a zone often several hundred feet wide known as the zone of deformation. This zone of deformation occurs mainly on the down thrown side of the main fault trace. Tectonic subsidence, caused by antithetic faults moving in the opposite direction of the main fault, slide down hill on the main fault scarp creating grabens (down dropped blocks) within the zone of deformation.

Hintze described an “enigma” of Utah in that seismicity does not always coincide with surface fault scarps or faults (Geologic History of Utah, 1988). The epicenter of the earthquake may be miles away from the surface faulting.

Liquefaction

Soil liquefaction occurs when water-saturated cohesionless sandy soils are subject to ground shaking. When liquefaction occurs soils behave more like a viscous liquid (quicksand) and lose their bearing capacity and shear strength. Two conditions must be met in order for soils to liquefy: (1) the soils must be susceptible to liquefaction (sandy, loose, water-saturated, soils typically between 0 and 30 feet below the ground surface) (2) ground shaking must be strong enough to cause susceptible soils to liquefy (lips). The loss of shear strength and bearing capacity due to liquefaction causes buildings to settle or tip and light buoyant structures such as buried storage tanks and empty swimming pools to float upward. Liquefaction can occur during earthquakes of magnitude 5.0 or greater.

Lateral Spread

Soils, once liquefied, can flow on slopes with angles of .5 to 5 percent this movement of liquefied soils is known as lateral spread. "The surficial soil layers break up and sections move independently, and are displaced laterally over a liquefied layer" (Eldredge 10). Liquefaction can cause damage in several way, with lateral spreading being one of the most common. Displacement of three (3) or more feet may occur and be accompanied by ground cracking and vertical displacement. Lateral spreading causes roads, buildings, buried utilities, and any other buried or surface structure to be pulled apart.

Various Flooding Issues Related to Earthquakes

Earthquakes could cause flooding due to the tilting of the valley floor, dam failure and seiches in lakes and reservoirs. Flooding can also result from the disruption of rivers and streams. Water tanks, pipelines, and aqueducts may be ruptured, or canals and streams altered by ground shaking, surface faulting, ground tilting, and landsliding.

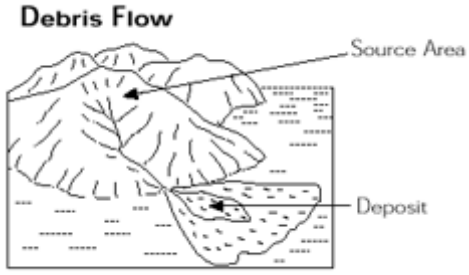
Seiches

Standing bodies of water are susceptible to earthquake ground motion. Water in lakes and reservoirs may be set in motion and slosh from one end to the other, much like in a bathtub. This motion is called a seiche (pronounced "saysh"). A seiche may lead to dam failure or damage along shorelines.

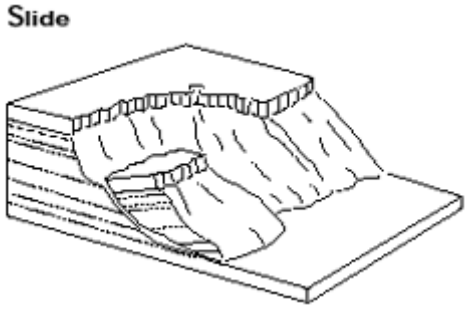
Landslides

Landslides are a "down slope movement of a mass of rock, earth, or debris". Landslides, often referred to as mass wasting or slope failures, are one of the most common natural disasters. (Cruden 36). Slope failures can vary considerably in shape, rate of movement, extent, and effect on surrounding areas. Slope failures are classified by there type of movement, and type of material. The types of movement are classified as falls, slides, topples, and flows. "The types of material include rock, debris (coarse grained soil) and earth (fine grained soil)" (Eldredge 17). "Types of slope failures then are identified as rock falls, rock slides, debris flows, debris slides, and so on" (Eldredge 17). Slope failures occur because of either an increases in the driving forces (weight of slope and slope gradient) or a decrease in the resisting forces (friction, or the strength of the material making up a slope). "Geology (rock type and structure), topography (slope gradient), water content, vegetative cover, and slope aspect are important factors of slope stability" (Eldredge 18).

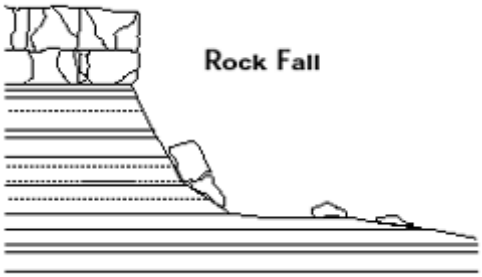
Three Common Types of Landslides in Utah



Debris flows consist of sediment-water mixtures that flow down a streambed or hillside, commonly depositing sediment at canyon mouths in fan like deposits know as alluvial fans.



Slides are down slope movements of soil or rock on slopes.



Rock falls consist of rock(s) falling from a cliff or cut slope and are very common in the canyon country of southern Utah.

Conditions That Make Slopes More Susceptible to Landslides

- Discontinuities: faults, joints, bedding surfaces.
- Massive Materials over soft materials.
- Orientations of dip slope: bedding plans that dip out of slope.
- Loose structure and roundness.
- Adding weight to the head of a slide area: rain, snow, landslides, mine waste piles, buildings, leaks from pipes, sewers, and canals, construction materials fill materials.
- Ground shaking: earthquakes or vibrations.
- Increase in lateral spread caused by mechanical weathering.
- Removal of lateral support.
- Human activities: cut and fill practices, quarries, mine pits, road cuts, lowering of reservoirs.
- Removing underlying support: under cutting of banks in a river.
- Increase in pore water pressure: snow melt, rain, and irrigation.
- Loss of cohesion.

Wildfire

A wildfire is an uncontrolled fire spreading through vegetative fuel often exposing or consuming structures. Wildfires often begin unnoticed and spread quickly and are usually sighted by dense smoke. Wildfires are placed into two classifications Wildland and Urban-Wildland Interface. Wildland fires are those occurring in an area where development is essentially nonexistent, except for roads, railroads, or power lines. Urban-Wildland Interface fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels.

When discussing wildfires it is important to remember that fires are part of a natural process and are needed to maintain a healthy ecosystem. Three basic elements are needed for a fire to occur (1) a heat source (2) oxygen and (3) fuel. Major ignition sources for wildfire are lightning and human causes such as arson, recreational activities, burning debris, and carelessness with fireworks. On average, 65 percent of all wild fires started in Utah can be attributed to human activities. Once a wildfire has started, vegetation, topography and weather are all conditions having an affect wildfire behavior.

Severe Weather

For the purpose of this mitigation plan the term severe weather is used to represent downbursts, lightening, heavy snowstorms, blizzards, avalanches, hail, and tornados.

Downbursts

A downburst is a severe localized wind, blasting from a thunderstorm. Depending on the size and location of these events, the destruction to property may be devastating. Downbursts fall into two categories by size. Microbursts cover and area less than 2.5 miles in diameter. Macrobursts cover an area with a diameter larger then 2.5 miles.

Lightening

During the development of a thunderstorm, the rapidly rising air within the cloud, combined with the movement of the precipitation within the cloud, causes electrical charges to build. Generally, positive charges build up near the top of the cloud, while negative charges build up near the bottom. Normally, the earth's surface has a slight negative charge. However, as the negative charges build up near the base of the cloud, the ground beneath the cloud and the area surrounding the cloud becomes positively charged. As the cloud moves, these induced positive charges on the ground follow the cloud like a shadow. Lightening is a giant spark of electricity that occurs between the positive and negative charges within the atmosphere or between the atmosphere and the ground. In the initial stages of development, air acts as an insulator between the positive and negative charges. When the potential between the positive and negative charges becomes to great, there is a discharge of electricity that we know as lightning.

Heavy Snowstorms

A severe winter storm deposits four or more inches of snow during a 12-hour period or six inches of snow during a 24-hour period. According to the official definition given by the U.S. Weather Service, the winds must exceed 35 miles per hour and the temperature must drop to 20° F or lower. All winter storms make driving extremely dangerous.

Blizzards

A blizzard is a snowstorm with sustained winds of 40 miles per hour (mph) or more or gusting winds up to at least 50 mph with heavy falling or blowing snow, persisting for one hour or more, temperatures of ten degrees Fahrenheit or colder and potentially life-threatening travel conditions. The definition includes the conditions under which dry snow, which has previously fallen, is whipped into the air and creates a diminution of visual range.

Hail Storms

Hailstones are large pieces of ice that fall from powerful thunderstorms. Hail forms when strong updrafts within, the convection cell of a cumulonimbus cloud carries water droplets upward

causing them to freeze. Once the droplet freezes, it collides with other liquid droplets that freeze on contact. These rise and fall cycles continue until the hailstone becomes too heavy and falls from the cloud.

Drought

Drought is a normal recurrent feature of climate, although many, in Utah, erroneously consider it a rare and random event. It occurs in virtually all-climatic zones, while its characteristics vary significantly from one region to another. Droughts, simple put, are cumulative hazards, which result from long periods of below normal precipitation. Drought is a temporary aberration and differs from aridity since the latter is restricted to low rainfall regions and is a permanent feature of climate.

The State of Utah uses the Palmer Drought Severity Index or (PDSI) to quantify the existence of a drought. Using the PDSI, drought is expressed as a negative number. Much of the basis, used by the State, to determine drought years, or drought periods, comes from the PDSI. In addition, the PDSI is used by the State Climatologist, the National Geophysical Data Center of NOAA, and the National Drought Mitigation Center.

For the most part droughts no longer affect the availability of drinking water, thus no longer place peoples lives at risk, the same can not be said for a persons livelihood. Numerous water projects throughout the state have placed enough water in storage to insure drinking water. Prolonged droughts have a significant affect on agricultural and agribusinesses, within the state dependent on irrigation water. Droughts also stress wildlife, and heighten the risk of wildfire.

Dam Failure

Dam failures result from the failure of a man made water impoundment structure, which often results in catastrophic down grade flooding. Dam failures are caused by one or a combination of the following: “breach from flooding or overtopping, ground shaking from earthquakes, settlement from liquefaction, slope failure, internal erosion from piping, failure of foundations and abutments, outlet leaks or failures, vegetation and rodents, poor construction, lack of maintenance and repair, misuse, improper operation, terrorism, or a combination of any of these” (Eldredge 46). The Utah State Engineer has been charged with regulating non-federal dams in the State dams since 1919. “In the late 1970's Utah started its own Dam Safety Section within the State of Utah Engineers Office to administer all non-federal dams in response to the Federal Dam Safety Act (PL-92-367)” (Eldredge 46).

The State Dam Safety Section has developed a hazard rating system for all non-federal dams in Utah. Downstream uses, the size, height, volume, and incremental risk/damage assessments or dams are all variables used to assign dam hazard ratings in Dam Safety’s classification system. Using the hazard ratings systems developed by the Dam Safety Section, dams are placed into one of three classifications high, moderate, and low. Dams receiving a low rating would have insignificant property loss do to dam failure. Moderate hazard dams would cause significant property loss in the event of a breach. High hazard dams would cause a possible loss of life in

the event of a rupture. The frequency of dam inspection is designated based on hazard rating with the Division of Water Rights inspecting high-hazard dams annually, moderate hazard dams biannually, and low-hazard dams every five years.

HAZARD ANALYSIS PROCESS

Geographic Information Systems (GIS) was used as the basic analysis tool to complete the hazard analysis for this report. For most hazards a comparison was made between mapped sources of hazard data and mapped layers that delineate where existing development is located. Data sources of existing development was obtained from a 1996 study conducted by the State of Utah Division of Water Resources that mapped water related land uses. Although the type of development was not determined, this study did identify geographically those areas where some sort of development has occurred. 1992 digital ortho aerial photographs as well as 2000 Census Block Group data was also used to determine the areas at risk and the magnitude of the risk.

One of the goals of this study is to estimate the number of homes, number of people, and dollar value of residential structures within any given hazard area. To this end, census data and natural hazard maps are the basic information used in the analysis. All the analysis takes place within the spatial context of a GIS. With the information available in spatial form, it is a simple task to overlay the natural hazards with census data to extract the desired information. For instance, to find the census blocks that in some manner affected by a hazard area. Once the census blocks have been identified, it becomes a matter of adding up the desired information from the census data. In this case we tally up the number of people and houses in each block. It is also possible to determine total home values of each block by multiplying the average block-group house value with total number of homes in the block. Hence we estimate the dollar value of homes within a hazard area at a block level.

It was realized early on, however, that even at a block level, census data can still be too spatially disaggregate for suitable results. In other words, census blocks do not show exactly where the variables that are being measured (i.e. houses, people, and house value) really exist. For example, if a small portion of a census block is in a hazard area it causes the entire block to be counted. In effect, all the homes in a census block are considered within the hazard area instead of the one or two that may truly be affected by the hazard. If this method had been used, then the results of the analysis would have overestimated the amount of each variable in a hazard area. Due to the possibility of significant error additional steps have been added for the analysis.

The first change to the original method is to add an additional data set that shows developed areas throughout the study area. Called the Water Related Land Use (WRLU), this land use classification allows the census information to be more precisely placed on the landscape. For the analysis, the WRLU was merged with census block boundaries. It is then assumed each variable given in the Census data for a given block can be place on the land considered developed in that block. Unfortunately, this method still has its shortcomings. While it more precisely locates the where homes are, it still doesn't fix the problem of a hazard only partially affecting a census block.

To deal with this situation, the census data for a given block is converted into a density value. Here is a hypothetical example, if the developed area of a given census block, say 10,000 meters^2, contains 150 people, then resulting population density is .015 people/meter^2. This same process can be used to calculate the two other variables, housing density (house/meter^2) and a housing value density (dollar/meter^2). Having calculated the three densities it is only a matter of determining the amount of space that a hazard occupies in the developed areas of each census block. Once that amount is known, it is multiplied by the density of the variable. Say, for example, that a hazard covers 2000 meters^2 of developed area in the hypothetical block above. The total people affected by the hazard would be 2000 meter^2 multiplied by .015people/meter^2 or 30 people. This process is performed for each block and the results are added together. It is in this manner that the total effects of a potential hazard are calculated for the study area.

A few assumptions had to be made in order to execute this model and produce results given the data available. The model is based on the assumption that both population and housing unit density is uniformly distributed across the areas identified as developed in the WRLU database (correlated to the census block). The housing unit value assigned to the Census Block was based on the figure provided in the Census Block Group (this variable is not available at the block level).

The potential loss estimates for commercial development (excluding home-occupation businesses) were determined by intersecting the various hazard data layers with a commercial\industrial business location GIS data layer. In this way, we were able to derive the number of businesses that were located in each hazard and their total estimated 2002 sales revenue.

Working with the various county tax assessors' offices, an attempt was made to look up the tax assessed value of all the businesses located in hazard zones. It was soon determined that the data could not be automatically extracted from the assessor's data bases. Each business would have to be looked up and pulled individually. With over 1000 businesses located in one or more hazard zones in the three counties, this proved too difficult.

As an alternative, the potential loss value of the commercial/industrial structures were determined by calculating an average 2002 value for each county and multiplying this figure by the number of businesses. The average value was calculated by dividing the total assessed value (land & buildings) obtained from a 2002 property tax report from the Utah State Tax Commission by the number of assessed businesses in each of the counties (obtained by each of the county's Assessors). Based on these calculations, the average business land & building value for Box Elder County was $343,872, Cache County $505,637 and Rich County $147,100. Unfortunately, this method will only provide a very rough approximation of commercial/industrial property at risk.

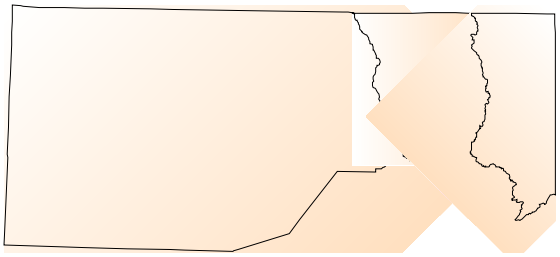
In terms of hazard mapping presentation in this document, portions of western Box Elder County and Eastern Cache County were excluded. These areas were not excluded from hazard identification and analysis. The decision to exclude these areas from the presentation mapping was designed to enhance the readability and usefulness of the mapping. Box Elder County has one of the largest geographic boundaries in the nation, yet only about 444 persons (1% of the

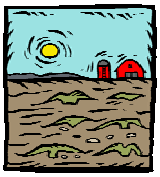
county's population) reside in the western portions; an area about five times the size of the more populated eastern portion of the county. Small unincorporated ranching communities such as Grouse Creek, Yost and Park Valley are located in Western Box Elder County. All incorporated cities were included in the mapping. Eastern Cache County was excluded from the mapping because it's mostly U.S. Forest Service land and virtually uninhabited (at least year round). Some second home cabin development is located in eastern Cache.

Areas not mapped in the presentation of the data were treated exactly the same as mapped portions in terms of hazard identification and analysis. Hazards issues for these portions excluded from mapping will be covered in the narrative portion of the document to the extent needed.

Effort to analyze hazards related to potential future development areas was also addressed where applicable. This proved to be a very difficult exercise and at best can identify general development trends and where potential conflicts may occur. No viable source of data exists to facilitate this sort of analysis. Zoning data does not necessarily indicate an area will be developed with a particular land use. Other development constraints such as availability of water/sewer or restrictions imposed by other general ordinances or regulations make the predictability of zoning difficult if not impossible. Nonetheless, an attempt was made to describe general growth trends as they related to particular hazards.

PART IV-BEAR RIVER DISTRICT ANNEX RISK ASSESSMENT





AGRICULTURAL RELATED HAZARDS

Background

Severe weather, drought, insect infestation and invasive noxious weeds have all had significant harmful impacts on the agricultural industry in the Bear River District. While these factors also impact the general public, the negative impacts are most acutely experienced by those in the agricultural sector. The agricultural sector is critical to the economies of Box Elder, Cache and Rich Counties. In Cache and Rich Counties the agricultural sector generates the greatest share of output to there respective county's economy.

History of Severe Weather in the Bear River District

Table IV-2: Prolonged Periods of Drought in the Region		
Box Elder County	**Cache County**	**Rich County**
1900-1903	1900-1903	1900-1903
1953-1960	1933-1935	1931-1935
1976-1977	1959-1961	1976-1979
1989-1992	1987-1992	1987-1992
1999-present	1999-present	1999-present
Palmer Drought Severity Index Chart from 1895-2001		

Table IV-3: History of Severe Weather Events in Box Elder County (1960-1999)			
Date	**Severe Weather Event**	**Date**	**Severe Weather Event**
April 1962	Wind	July 1982	Wind
October 1962	Wind	April 1983	Wind
November 1964	Wind	April 1986	Wind
September 1995	Hail, Lightning, Severe Storm/Thunder Storm, Winter Weather	December 1990	Sever Storm/Thunder Storm, Wind
March 1967	Wind, Winter Weather	January 1991	Fog
April 1967	Wind	January 1993	Winter Weather
June 1969	Hail, Wind	February 1996	Winter Weather
December 1970	Winter Weather	March 1996	Winter Weather
February 1971	Wind	November 1996	Winter Weather
August 1971	Sever Storm/ Thunder Storm	December 1996	Winter Weather
March 1973	Winter Weather	January 1997	Winter Weather
November 1973	Wind	February 1997	Winter Weather
March 1974	Wind, Winter Weather	March 1997	Winter Weather
April 1974	Wind, Winter Weather	April 1997	Winter Weather
March 1975	Winter Weather	October 1997	Winter Weather
April 1975	Winter Weather	November 1997	Winter Weather
May 1975	Winter Weather	December 1997	Winter Weather
July 1975	Winter Weather	January 1998	Winter Weather
November 1975	Winter Weather	February 1998	Winter Weather
December 1975	Winter weather	March 1998	Winter Weather

Table IV-3: History of Severe Weather Events in Box Elder County (1960-1999)			
Date	**Severe Weather Event**	**Date**	**Severe Weather Event**
February 1976	Wind, Winter Weather	April 1998	Winter Weather
March 1976	Wind. Winter Weather	June 1998	Winter Weather
April 1976	Wind, Winter Weather	November 1998	Winter Weather
June 1976	Winter	December 1998	Winter Weather
August 1978	Hail, Severe Storm/Thunder Storm, Wind	January 1999	Winter Weather
January 1979	Winter Weather	April 1999	Winter Weather
May 1979	Hail, Wind	December 1999	Winter Weather
July 1981	Lightning		
Source: National Climatic Data Center (http://www.ncdc.noaa.gov/oa/ncdc.html)			

Table IV-4: History of Severe Weather Events in Cache County (1960-1999)			
Date	**Severe Weather Event**	**Date**	**Severe Weather Event**
June 1960	Hail, Frost	April 1990	Severe Storm/ Thunder Storm, Winter Weather
April 1962	Wind	December 1990	Severe Storm/Thunder Storm, Wind
November 1964	Wind	January 1991	Fog, Winter Weather
September 1965	Hail, Lightning, Severe Storm/Thunder Storm, Winter Weather	May 1991	Wind
March 1967	Wind, Winter Weather	January 1993	Winter Weather
April 1967	Wind	January 1993	Winter Weather
January 1971	Winter Weather	February 1996	Winter Weather
February 1971	Winter Weather	March 1996	Winter Weather
July 1971	Hail	October 1996	Winter Weather
August 1971	Severe Storm/Thunder Storm	November 1996	Winter Weather
December 1972	Wind, Winter Weather	December 1996	Winter Weather
November 1973	Wind	January 1997	Winter Weather
December 1973	Avalanche, Winter Weather	February 1997	Winter Weather
January 1974	Winter Weather	March 1997	Winter Weather
March 1975	Winter Weather	April 1997	Winter Weather
November 1975	Winter Weather	October 1997	Winter Weather
December 1975	Winter Weather	November 1997	Winter Weather
February 1976	Winter Weather	December 1997	Winter Weather
April 1976	Wind	January 1998	Winter Weather
June 1976	Winter Weather	February 1998	Winter Weather
November 1978	Winter Weather	March 1998	Winter Weather
November 1979	Winter Weather	April 1998	Winter Weather
January 1980	Wind	June 1998	Winter Weather
August 1980	Hail	November 1998	Winter Weather
July 1981	Lightning	December 1998	Winter Weather
April 1983	Wind	January 1999	Winter Weather
March 1984	Wind	April 1999	Winter Weather
July 1986	Sever Storm/Thunder Storm, Wind	December 1999	Winter Weather
September 1989	Tornado		
Source: National Climatic Data Center (http://www.ncdc.noaa.gov/oa/ncdc.html)			

Table IV-5: History of Severe Weather Events in Rich County (1954-1999)			
Date	**Severe Weather Event**	**Date**	**Severe Weather Event**
May 1954	Tornado	March 1997	Winter Weather
April 1962	Wind	May 1997	Winter Weather
September 1965	Hail, Lightning, Sever Storm/Thunder Storm, Winter Weather	October 1997	Winter Weather
March 1967	Wind, Winter Weather	November 1997	Winter Weather
January 1971	Winter Weather	December 1997	Winter Weather
December 1972	Wind, Winter Weather	January 1998	Winter Weather
March 1975	Wind, Winter Weather	February 1998	Winter Weather
November 1975	Winter Weather	March 1998	Winter Weather
December 1975	Winter Weather	April 1998	Winter Weather
July 1981	Lightning	June 1998	Winter Weather
December 1990	Severe Storm/thunder Storm, Wind	November 1998	Winter Weather
January 1991	Winter Weather	December 1998	Winter Weather
February 1996	Winter Weather	January 1999	Winter Weather
November 1996	Winter Weather	April 1999	Winter Weather
December 1996	Winter Weather	December 1999	Winter Weather
January 1997	Winter Weather		
February 1997	Winter Weather		
Source: National Climatic Data Center (http://www.ncdc.noaa.gov/oa/ncdc.html)			

Table IV-6: Bear River District Grasshopper Infested Acreage (1998-2002)					
County	1998	1999	2000	2001	2002
Box Elder	100,000	100,000	55,000	120,400	120,000
Cache	0	0	19,000	64,500	17,000
Rich	0	0	0	12,400	0
Source: 2002 Insect Report, Utah Department of Agriculture and Food					

Table IV-7: Bear River District Mormon Cricket Infested Acreage (1998-2002)					
County	1998	1999	2000	2001	2002
Box Elder	0	0	0	0	108,300
Cache	0	0	19,000	8,100	4,400
Rich	0	0	0	0	0
Source: 2002 Insect Report, Utah Department of Agriculture and Food					

Regional Hazard Assessment

Drought Hazard Profile	
Frequency	Frequent
Severity	Severe mostly for agricultural producers
Location	Un-irrigated areas are most impacted
Seasonal Pattern	Water supply dependent on winter snowfall. Summer is when impact is realized.
Duration	As many as 10 years
Speed of Onset	Incremental with impact increasing
Probability of Future Occurrences	High-the region is one of the worst drought cycles in many years.

Severe Weather Hazard Profile	
Frequency	Frequent
Severity	Severe mostly for agricultural producers
Location	Everywhere (Some areas have more inherent risk due to geographic conditions)
Seasonal Pattern	Summer severe thunderstorms/hail & wind, Late spring freezing, and heavy winter storms
Duration	Days
Speed of Onset	Immediate
Probability of Future Occurrences	High

Insect Infestation Hazard Profile	
Frequency	Sporadic
Severity	Severe mostly for agricultural producers
Location	Everywhere
Seasonal Pattern	Spring & early summer
Duration	Months
Speed of Onset	Days
Probability of Future Occurrences	High

The State of Utah is currently in the fifth year of a drought. While data has not yet been compiled, 2003 is shaping up to be one of the worst insect infestation years in recorded history. All three counties have been declared agricultural disaster areas by the U.S. Department of Agriculture. Certainly, the drought cycle has exacerbated the insect infestation problem.

Severe weather can potentially impact agricultural crop production. Increased risks are associated with certain times in the crop growth cycle. These vary depending on the crop. In general, many crops can be damaged by heavy rainstorm, hail or high winds. Unusually late frost can damage some crops. Fruit production located mostly in Eastern Box Elder County can be significantly damaged by late frosts as well as other severe weather.

Assessing Vulnerability: Identifying Assets & Estimating Losses

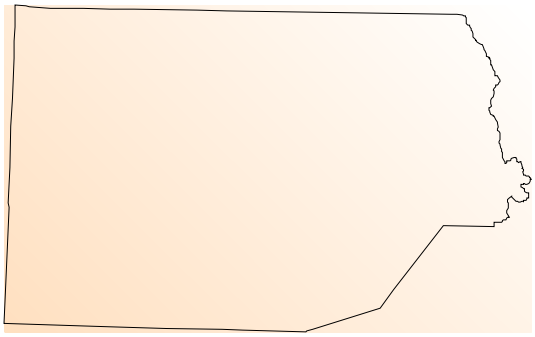
Table IV-8: Bear River District 1997 Agriculture Economic Profile				
County	**Number of Farms**	**Acres in Farm**	**Market Value of Ag products sold**	**Estimated Average Value of land & building (per farm)**
Box Elder	1,077	523,744	$102,173,000	$547,243
Cache	1,232	266,374	$104,809,000	$329,665
Rich	162	1,357,734	$15,538,000	$853,906
Source: 1997 Census of Agriculture, U.S. Department of Agriculture				

Although the final tally has not been compiled, to-date the USDA Crop Insurance Program has paid out a total of $13.2 Million in disaster assistance to farmers in Box Elder, Cache and Rich Counties for 2001-2002. Since payouts only represent a portion of actual damages, it is estimated that actual damages for 2001-2002 were over $26 Million from severe weather, insect infestation and drought in the Bear River District (Phone conversations with Box Elder, Cache and Rich Farm Services Agency, USDA).

Assessing Vulnerability: Analyzing Development Trends

The urbanization of eastern Box Elder County and the Cache Valley means access to irrigation water for agricultural purposes will become increasing more difficult. In terms of competition for limited water resources, agricultural uses often lose out to increasing urban demands. This problem is likely to get worst for agricultural users and especially becomes evident during a drought period such as the one we are currently experiencing. Even today some rumblings of legal action have occurred between urban users and agricultural users.

PART IV-BOX ELDER COUNTY ANNEX RISK ASSESSMENT



GENERAL BACKGROUND INFORMATION

Box Elder County is located in the northwest corner of Utah extending from the western edge of the Wasatch Mountains to the Idaho border and then west to the Nevada border. Box Elder County is surrounded by Cache, Weber, Tooele, and Davis Counties, and is the fourth largest of Utah's counties. Created in 1856, it was named for its abundance of Box Elder trees throughout the County.

Early inhabitants of the County were prehistoric hunters and gatherers that roamed the area as early as 12,000 years ago. In the 1820s and '30s fur trappers, including Peter Skene Ogden and Joseph Walker explored the eastern and northern parts of the County. Permanent white settlement began in 1851 when a group of Mormon pioneers settled in present day Willard. The area was already inhabited by Shoshone Indians when the Mormon settlers entered the area. This resulted in livestock raids and violent confrontations between the Indians and the settlers. On July 30, 1863, Territorial Governor James Duane Doty negotiated the Treaty of Box Elder ending the conflict between the Shoshone Indians and the settlers. In 1856 the territorial legislature created Box Elder County from part of Weber County.

Box Elder is historically known for the Golden Spike National Historical Site where, in May of 1869, the driving of the Golden Spike, in Promontory, joined the Union Pacific Railroad from Omaha, Nebraska, and the Central Pacific Railroad from the Pacific Coast. A dramatization of that ceremony is reenacted every year, allowing visitors to witness the event.

The County contains rich farmlands consisting of 43% of the County's land use, and leads all Utah counties in the economic value of its' agricultural products. The standard crops are hay, grain, alfalfa, and the County is also known for its peaches and other fruit crops. Besides its agriculture, Box Elder County is home to several large manufacturing facilities including ATK Thiokol Propulsion Corporation, the single largest employer in the County which operates two rocket motor and missile plants and produces fuel for space vehicles. Autoliv, the automobile airbag manufacturer, is also a major employer which is expanding rapidly. Others include Nucor Steel, Vulcraft and LA-Z-Boy of Utah.

Box Elder County is a county whose economy and fortunes have been closely tied to individual industries throughout its history. Starting with early reliance on the opportunities made available by the trans-continental railroad, the sugar beet industry, and then most recently, the Thiokol Corporation and the military industrial complex.

The County recently has increased efforts to diversify its economy to avoid reliance on single markets and it shows signs of succeeding in this effort. The growth trend in Box Elder County is less rapid than Cache County but as the Wasatch Front becomes built out there will be increased pressure on Box Elder County to absorb future growth.

Although Box Elder County had its economic beginnings in agriculture and livestock production, manufacturers in the defense and space industry have given the county higher employment rates and per capita incomes than the rest of the state. Agriculture still plays a large part in the regional economy, but is increasingly seen as a source of supplemental income. Primary crops

include hay, silage corn and grain used to feed livestock and dairy herds. Only one-fifth of Box Elder County residents remain farmers. The manufacturing sector has diversified and grown at a steady rate in Box Elder County reducing the importance of agriculture to local economies. Simultaneously, employment opportunities have steadily moved from the agricultural sector to the manufacturing sector. Many employees have migrated from national and international locations for high paying jobs at ATK Thiokol Propulsion Corporation, a major aerospace and defense contractor that has historically been Box Elder County's largest employer. In fact, mostly because of Thiokol, Box Elder County has traditionally been a county of higher employment and higher per capita income than most Utah counties. (See the "Population Density and "Land Ownership" map in the map section of the county annex)

Table IV-9: Box Elder County Participating PDM Jurisdictions			
Box Elder County	Bear River City	Brigham City	Corinne City
Deweyville Town	Elwood Town	Fielding Town	Garland City
Honeyville City	Howell Town	Mantua Town	Perry City
Plymouth Town	Portage Town	Snowville Town	Tremonton City
Willard City			

BOX ELDER COUNTY FLOODING

Background

Areas in Box Elder County have experienced significant impacts related to flooding in the recently recorded history. Box Elder County has several large rivers and smaller tributaries that are susceptible to flooding. The Bear River is the largest river in the county. A hydroelectric dam is located on the Bear River shortly after it enters the county from Cache County. Located mostly in Cache County, Cutler reservoir is formed as a result of this dam. The existence of this dam does provide some meaningful flood control for downstream portions of the Bear in Box Elder County. Other major rivers are the Malad River and Box Elder Creek. A number of smaller often intermittent streams are located in some of the canyons of the Wellsville and Wasatch Mountains. Each of these streams can pose a threat in terms of flooding. In addition a number of canals are located in the county that under certain conditions may fail or overflow and result in flooding.

Most flooding in Box Elder County is attributed to snowmelt rates in surrounding watersheds that are in excess of the capacity of the drainage systems or unusually heavy storm events that temporarily overwhelmed drainage capacity (or a combination of the both). Some limited flooding is the result of rising groundwater levels. **See the "FEMA Flood Zone" Map in the county annex map section.**

History of Flooding in Box Elder County

In terms of property damage and disruption of community life, Brigham City along with the Willard/Perry area has been the communities most impacted historically by flooding. The floods of August 1923 in Willard were some of the most destructive in the State's recorded history. A significant portion of Willard was inundated by flood water and associated mud and debris flows. Four dwellings were destroyed and two women died when their homes were demolished (see cover photos).

In the mid-1980's large portions of Box Elder County were negatively impacted by the rise in the level of the Great Salt Lake. A significant amount of high value wetlands and agricultural land surrounding the lake were flooded by the rise of the briny water, including the Bear River Bird Refuge. Although their immediate value was reduced by a natural dry cycle that resulted in the lake level dropping, the State of Utah installed large pumps on the lake to moderate the rise of the lake by moving the water to the west desert. These pumps can return to operation if needed.

Following is a summary of significant flooding events in Box Elder County from 1847 to present:

Table IV-10: Box Elder County Flood History 1847-2003		
Location	Date	Description
Brigham City	1851	Box Elder Creek flooding through early settlement.

Table IV-10: Box Elder County Flood History 1847-2003		
Location	Date	Description
	1881, 1907	No information available
	Feb 1911	Snowmelt and heavy rain resulted serious damage to homes, roads and bridges.
	Aug 1947	Crop & road damage, flooded homes
	May 1957	Low area flooding
	Aug 1959	Extensive road damage
	June 1960	Crop damage
	June 1963	Crop damage and flooded homes
	June 1969	Main Street flooding and one home
	Spring 1983	Homes flooded, waste treatment plant threatened by Box Elder Creek.
Fielding	July 1957	Flooded highway, crop damage
	1958, 1979, 1980	No information available
Garland	1899, 1918,1980	No information available
	Spring 1983	Dike along Bear River failed and damaged community water supply pump house.
Honeyville	Spring 1983	Homes flooded from high groundwater
Howell	1968,1969,1980	No information available
Perry	May 1949	Road, orchard and crop damage
Plymouth	1891,1941	No information available
Promontory	Sept 1959	Crop damage
Snowville	June 1953	Crop damage, road closure
	1954, 1980	No information available
Thatcher	1934,1980	No information available
Willard	1906,1912	No information available
	Aug 1923	Widespread flooding and debris flow. Significant property damage and loss of life.
	Aug 1952	$100,00 in damage to orchard
	Sept 1982	Flooding from Holmes Canyon east of Willard. Road damage as flood waters crossed U.S. 89 at about 680 South.
	Spring 1983	Several homes flooded, Facer Canyon Flooding
Land around the Great Salt Lake	1982-1984	Flooding of land around the Great Salt Lake (wetlands and agricultural land).
Entire County	Spring 1984	Debris flows on private land, debris basins in Willard filled to capacity. Widespread road damage.
FEMA Flood insurance study for Brigham City, 2-17-81, Local Surveys (see appendix A) (Butler & Marsell, 1972), (Division of Comprehensive Emergency Management, 1981)		

Box Elder County Flood Hazard Assessment
Hazard Profile

Frequency	Some flooding occurs nearly every year in Box Elder County
Severity	Moderate
Location	Generally along rivers, streams and canals.
Seasonal Pattern	Spring flooding as a result of snowmelt. Mid-late summer cloudburst events.
Duration	A few hours or up to three weeks for snowmelt flooding
Speed of Onset	1-6 hours
Probability of Future Occurrences	High-for delineated flood plains there is a 1% chance of flooding in any given year.

Taken as a whole, Box Elder County has relatively minor flood threats. This, in part, is reflected in the low number of communities participating in the National Flood Insurance Program (NFIP). Nonetheless, significant flooding has occurred in the past and with certainty will occur in the future. The question is when, where and to what extent?

Given existing and potential future development, areas around the Bear and Malad Rivers are most likely to see impacts related to flooding. At present most of the risk for flood damage is centered on potential agricultural loses. Certainly as more development occurs, if it is not properly managed, threats to structures and human safety will certainly increase.

Analysis of areas of Box Elder County mapped by FEMA for communities that participate in the NFIP indicate some conflict related to existing development located in what has been determined to be the 100 year floodplain. Digitized floodplain maps for Box Elder County were overlaid on a layer of Digital Ortho Aerial Photographs as well as a 1996 data layer that delineates "developed" areas (Water Related Land use Study produced for the State of Utah Division of Water Resources). An August 2003 report Flood Hazard Identification Study: Bear River Association of Governments by the U.S. Army Corps of Engineers was also used to determine flood risk for communities that do not have FEMA Firm flood plain maps (See Appendix B for the full report).

Numerous isolated pockets of development (generally limited to 1-3 farmsteads) are located in the **unincorporated portions of Box Elder County**. Some of these isolated developments located largely adjacent to the Malad River and to a lesser degree the Bear River and various intermittent streams are at least partially located in the 100 year floodplain.

Other areas of concern related to risk of flooding are the development located on the south side of 600 north in **Brigham City** as it extends from about 900 west to 1200 west. This area, as well a couple of small isolated areas in the center of Brigham City are located in Box Elder Creek's 100 year flood plain. Small areas adjacent to 500 north from about 200 west to 400 west may be impacted by overflow flooding of Box Elder Creek. This would likely impact about 7-10 homes. The area west of Brigham City on 600 north would mostly impact industrial development.

The Ogden-Brigham (Pineview) Canal flows into Brigham City from the south. It enters the southern part of the county and flows through or above Willard, Perry and Brigham City. The Perry Canal begins in an equalization pond below Mantua Reservoir and flows partially through Brigham as it flows to Perry City to the south. These two canals parallel each other for a time flowing in opposite directions. Historically, not much flooding has occurred related to these canals. About three years ago the Perry Canal overflowed with spring runoff around 6th South 800 East in Brigham due to a blocked culvert a one home was flooded. Brigham City could be impacted by upstream conditions on the Pineview Canal (see Willard discussion).

Deweyville Town is located east of the Bear River. However all development is located considerable distance from the river and does not seem to be at risk from Bear River flooding. Some eastern tributaries flowing off the Wellsville mountains present a threat to portions of the town from site specific flooding. However not many drainage routes exist on the Western side of the Wellsville Mountains. The soil types present essentially absorb most potential runoff. Flows occur only on extreme weather events. A similar situation occurs for **Honeyville Town**. Deweyville does not participate in the NFIP and has not been mapped for flooding (See appendix B).

The Eastern portion of **Plymouth Town** appears to be vulnerable to flooding. The north eastern portion seems especially vulnerable. Because the town does not participate in the NFIP no flood plain map has been produced. Some approximation is required in carrying the flood boundary that has been mapped for the adjacent unincorporated county through the town of Plymouth. Nonetheless, it appears that about 7-10 residential units are threatened from flooding by these intermittent drainages (See Appendix B).

Snowville Town has several relatively large Deep Creek tributary drainages that are located in or near the town. Snowville does not participate in NFIP and so no official flood plain map has been produced for the town. Flooding from the intermittent tributaries would seem to pose a significant flood threat for a large portion of the community (See Appendix B).

Tremonton City does not participate in the NFIP as a consequence flood plains have not been delineated for the community. For the most part the community has no risk from flooding. However the eastern part of the community along the Malad River suggest that some flooding is possible in developed portions of Tremonton City. “The limited detail floodplains identified on the adjacent county map reflect what should be considered a minimal flood hazard area” (See Appendix B). If the rough extend of the Malad River floodplain boundary mapped for the unincorporated county carried through the Tremonton Boundary, approximately seven residences are threatened by flooding based on a 100 year event.

Willard City has experienced some of the worst flooding in the state’s history (see cover photos). Certainly many changes have occurred and improvements made since the flooding in the early 1900s. Nonetheless some flooding vulnerability still exists for residents of Willard.

Much of the steep mountainous area east of **Perry City** to the north, Willard and the South Willard area extending to the Weber County line on the south are drained by a number of steep

mountain canyons. These include Facer, Willard, Cook, Holmes and Pearsons Canyons. A long history of flood related problems have occurred in some of these canyons (especially above Willard City). Further exacerbating the situation is the presence of the Ogden-Brigham Canal (Pineview) that runs perpendicular to these canyon drainages at the base of the foothills.

Responding to flooding, significant flood control work has been completed in these drainages (much of it done by Civilian Conservation Corps (CCC) crews). Detention basins have been constructed at Facer Creek, Willard Creek and Pearson Canyon. Land terracing has been completed on the upper portion of the Willard Creek drainage. Gabions have been installed to direct flood waters in Pearson and Holmes Canyons. In addition a number of debris basins have been constructed.

Community officials have also attempted to respond to flood water from east-west canyons entering the northern flowing Ogden-Brigham Canal. Chutes have been built over the canal and most of the sections of the canal subject to flooding have been piped to prevent flood waters and debris from entering the canal. Also storm water pipes have been installed to help handle storm water discharges for Perry and Willard cities (RB & G Engineering, Inc, 1999).

Assessing Vulnerability: Identifying Assets & Estimating Losses

Table IV-11: Box Elder County Flood Risk Residential and Commercial

Jurisdiction Name	Population	Residential Development at Risk		Commercial Development at Risk (x 1000)	
		Units	Value	Units	Income*/Structures**
Bear River City	Incomplete data-No flood plain map (See appendix B)				
Brigham City	43	16	$1,743,539	6	$9,200/$2,057
Corinne City	2	1	$63,524		
Deweyville Town	Incomplete data-No flood plain map (See appendix B)				
Elwood Town	4	1	$107,650		
Fielding Town	Incomplete data-No flood plain map (See appendix B)				
Garland City	Incomplete data-No flood plain map (See appendix B)				
Howell Town	Incomplete data-No flood plain map (See appendix B)				
Mantua Town	28	8	$1,196,045		
Perry City	16	5	$702,453		
Plymouth Town	Incomplete data-No flood plain map (See appendix B)				
Portage Town	Incomplete data-No flood plain map (See appendix B)				
Snowville Town	Incomplete data-No flood plain map (See appendix B)				
Tremonton City	Incomplete data-No flood plain map (See appendix B)				
Unincorporated	258	75	$9,462,303	68	$87,000/$23,000

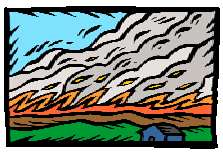
Population and Residential Development estimates are derived using 2000 Census data
*****2002 estimated total sales revenue (Census)
** Based on average 2002 assessed commercial building value for Box Elder County
(2002 State Tax Commission Report & Box Elder County Assessor's Office)
Note: Communities not listed have no residential or commercial property identified in the hazard.

Table IV-12: Box Elder County Flooding Other Facilities at Risk				
Jurisdiction Name	**Critical Facilities**	**Roads**	**Power lines**	**Rail Lines**
Bear River City	Incomplete data-No flood plain map (See appendix B)			
Brigham City		.2 miles Interstate\$6 Million .9 miles two lane\$2.8 Million		.2 miles\$48,227
Deweyville Town	Incomplete data-No flood plain map (See appendix B)			
Elwood Town		.3 miles\$930,000		
Fielding Town	Incomplete data-No flood plain map (See appendix B)			
Garland City	Incomplete data-No flood plain map (See appendix B)			
Honeyville City	Honeyville School (closed)	1 mile Interstate\ $30 million 2.2 miles 2 lane\$6.8 million		.94 miles\$226,666
Howell Town	Incomplete data-No flood plain map (See appendix B)			
Perry City		.2 miles\$620,000		.05 miles\$12,056
Plymouth Town	Incomplete data-No flood plain map (See appendix B)			
Portage Town	Incomplete data-No flood plain map (See appendix B)			
Snowville Town	Incomplete data-No flood plain map (See appendix B)			
Tremonton City	Incomplete data-No flood plain map (See appendix B)			
Unincorporated		3.1 miles Interstate\$93 million 39.1 miles two lane\$121 million		6.07 miles\$1.5 million
See Appendix D for data sources and cost factors. **Note: Jurisdictions not listed have no identified facilities at risk.**				

Assessing Vulnerability: Analyzing Development Trends

The area south of Willard along Highway 89 to the Weber County line is posed to be the county's high growth area. This area is in the process of developing a sewer system to accommodate new development demand. Design proposals are being developed for as many as 1000 new housing units. Some of this housing demand will come from Weber County residences looking to relocate.

If not properly sited, new development along this corridor could very likely be vulnerable to flooding from adjacent mountain drainages. At least some of the new development growth is likely to go on the east side of U.S 89 above and below the Ogden-Brigham Canal. This poses a potential flood threat from the canal itself but also would add new stormwater runoff to the canal. It would be generated from the impervious surfaces of new development upslope from the canal. This could impact downstream residences in Willard City, Perry City and Brigham City.



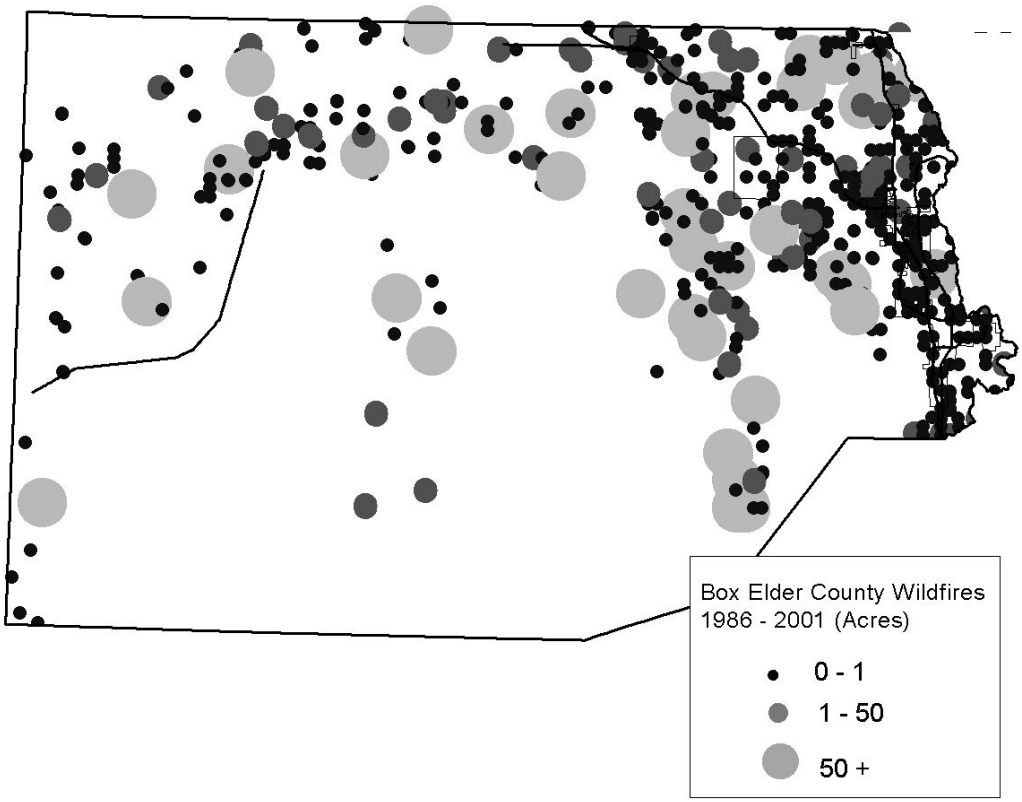
BOX ELDER COUNTY WILDFIRES

Background

The vast majority of Box Elder County has minimal threat from wildfire. Most of western Box Elder County is sage and scrub vegetation. In these areas when wildfires start they are relatively easy to contain and protect developed property. Where the highest risk occurs in Box Elder County is on the urban fringe and wildland interface primarily along the base of the Willard and Wellsville mountains. Some scattered second home developments are also at risk from wildfire. **See the "Wildfire Hazard" Map in the county annex map section.**

History of Wildfires in Box Elder County

Major fires in Box Elder County include the "Wildcat", "Fort Ranch", "Thiokol", "Pilot Peak", "Dry Canyon", "Morris Ranch", and "West Hills" fires. The following graphic illustrates the number and rough locations of wild fires in Box Elder County in the 15 year period from 1986 to 2001. In 1992 a large fire burned uncontained for over a week in the mountains above Perry City.



Box Elder County Wildfire Hazard Assessment
Hazard Profile

Frequency	Annually to some extent
Severity	Severe
Location	Dispersed throughout the whole county
Seasonal Pattern	Generally the worst from early July to mid September (depends on drought conditions)
Duration	A few hours to two weeks
Speed of Onset	1-6 hours
Probability of Future Occurrences	Very High (Based on data from 1986-2001, there is a 52% chance a fire of at least 1000 acres will occur every year)

A few subdivisions on the eastern edge of Brigham City are located immediately adjacent to wildfire prone areas.

Located in the unincorporated county north of **Deweyville Town** along the base of the Wellsville Mountains is located the Cedar Ridge Subdivision. Many of these homes are located in a high risk wildfire area.

Assessing Vulnerability: Identifying Assets & Estimating Losses

Table IV-13: Box Elder County Wildfire Risk Residential and Commercial

Jurisdiction Name	Population	Residential Development at Risk		Commercial Development at Risk (x 1000)	
		Units	Value	Units	Income*/Structures**
Brigham City	562	157	$20,213,196	7	$6,000\$2,400
Honeyville City	13	5	$674,928		
Mantua Town	28	8	$989,561	1	$100\$342
Perry City	30	9	$1,266,446		
Willard City	34	17	$1,430,014		
Unincorporated	340	95	$13,871,710	6	$33,000\$2,057

Population and Residential Development estimates are derived using 2000 Census data
*****2002 estimated total sales revenue (Census)
** Based on average 2002 assessed commercial building value for Box Elder County (2002 State Tax Commission Report & Box Elder County Assessor's Office)
Note: Communities not listed have no residential or commercial property identified in the hazard.

Table IV-14: Box Elder County Wildfires Other Facilities at Risk

Jurisdiction Name	Critical Facilities	Roads	Power lines	Rail Lines
Bear River City			1.2miles/$57,521	
Deweyville Town			1.1miles 345Kv line/ $53,035 7.2miles 138Kv line/$354,125	
Honeyville City			1.4miles 345Kv line/$67,500 3.5miles 138Kv line/$67,769	
Unincorporated			3.8 miles 345Kv line\$183,213 1.9 miles 230Kv line\$91,694 24 miles 138Kv line\$1.1 million	2.28miles/$549,788

See Appendix D for data sources and cost factors.
Note: Jurisdictions not listed have no identified facilities at risk.

Assessing Vulnerability: Analyzing Development Trends

The areas that expose development to the most risk from wildfires are often the most desirable places to live. These places afford residents good views, access to public lands, open space and a connection with nature. Most jurisdictions have found it difficult to restrict, limit or modify development proposals for these areas.

In terms of future development trends Brigham City, Willard, South Willard and Mantua will likely see the most growth pressure in these fire prone areas. Brigham City recently proposed extending its eastern town boarder to U.S 91 north of Mantua Town. News reports indicate as many as 300 housing units may be proposed for the area. This area is all classified as high or extreme in terms of wildfire hazard.

Development that is being talked about in South Willard (east of U.S. 89) could put numerous homes at risk from wildfire depending on where it is sited.

As Brigham City, Willard, Honeyville and Mantua continue to grow; development pressure will likely increase on the margins of town and the trend will likely be to develop higher on the foothills. Some of this risk is moderated by the presence of U.S. Forest Service land that will set some bounds on this trend in certain areas.

BOX ELDER COUNTY LANDSLIDES

Background

Landslides are most common in Box Elder County at the base of the Willard Mountains from Perry south to the Weber County line. Landslides do not pose much of a problem for other parts of the county. **See the "Landslide Potential" Map in the county annex map section.**

History of Landslides in Box Elder County

Table IV-15: Box Elder County Landslide Areas	
Active Landslides (in Acres)	Historically Active Landslides 1847 to present (in Acres)
490	103,770

Debris flows associated with the 1923 flooding of Willard City were very destructive and destroyed a number of homes and building. Main Street Willard was covered in a thick layer of mud, rocks and debris. The force was strong enough to move large boulders (See cover photo).

In 1949 a five mile stretch of U.S 89 between South Willard and Utah Hot Springs was covered with mud, rocks and boulder.

In late May 1983 a large landslide occurred on the face of the mountain north of Willard near Facer Creek. Also in 1983-84 Three Mile Canyon near Perry City experienced a mud slide. As a result over $1 Million was spend constructing a detention basin and overflow facilities.

Box Elder County Landslide Hazard Assessment
Hazard Profile

Frequency	Annually to some extent
Severity	Sever
Location	Dispersed throughout the whole county
Seasonal Pattern	Generally the worst from early July to mid September (depends on drought conditions)
Duration	A few hours to two weeks
Speed of Onset	1-6 hours
Probability of Future Occurrences	Very High

The Perry to South Willard area along the base of the Willard Mountains has had ongoing problems with debris flows, landslides and flash flooding. A number of debris basins have been constructed as well as other debris flow management structures. Portions of the Ogden-Brigham Canal susceptible to debris flow blockage have been placed in culvert to avoid flooding.

Assessing Vulnerability: Identifying Assets & Estimating Losses

Table IV-16: Box Elder County Landslide Risk Residential and Commercial (Active & Historically Active Landslides)

Jurisdiction Name	Population	Residential Development at Risk		Commercial Development at Risk (x 1000)	
		Units	Value	Units	Income*/Structures**
Brigham City	131	25	$3,156,549		
Deweyville Town	52	19	$2,673,932		
Honeyville City	458	136	$15,697,737	3	$600/$1,028
Perry City	37	17	$1,462,448		
Willard City	525	185	$23,748,463	10	$1,500/$3,438
Unincorporated	377	117	$16,021,369		

Population and Residential Development estimates are derived using 2000 Census data
*****2002 estimated total sales revenue (Census)
** Based on average 2002 assessed commercial building value for Box Elder County (2002 State Tax Commission Report & Box Elder County Assessor's Office)
Note: Communities not listed have no residential or commercial property identified in the hazard. Data does not include areas susceptible to debris flows (no data available).

Table IV-17: Box Elder County Landslides Other Facilities at Risk (Active & Historically Active Landslides)

Jurisdiction Name	Critical Facilities	Roads	Power lines	Rail Lines
Deweyville Town		0.6miles/$1,860,000	0.1miles/$4,821	
Honeyville City		4.3miles/$13,300,000	0.8miles 345Kv line/$38,571 1.1miles 138Kv line/$52,727	.33miles/$179,575
Willard City	Police/Fire Station, Willard School	4.5miles/$13,950,000	0.8miles/$38,347	
Unincorporated		19.1miles/$59,210,000	1.2miles 345Kv line/$57,857 6.9miles 138Kv line/$330,745	2.42miles/$583,547

See Appendix D for data sources and cost factors.
Note: Jurisdictions not listed have no identified facilities at risk. Data does not include areas susceptible to debris flows (no data available)

Table IV-18: Box Elder County Landslide Risk Residential and Commercial (Active Landslides Only)

Jurisdiction Name	Population	Residential Development at Risk		Commercial Development at Risk (x 1000)	
		Units	Value	Units	Income*/Structures**
Perry City	9	3	$426,209		
Willard City	525	185	$23,748,463	10	$1,500/$3,438
Unincorporated	89	27	$3,366,168		

Population and Residential Development estimates are derived using 2000 Census data
*****2002 estimated total sales revenue (Census)

** Based on average 2002 assessed commercial building value for Box Elder County
(2002 State Tax Commission Report & Box Elder County Assessor's Office)
Note: Communities not listed have no residential or commercial property identified in the hazard.

Table IV-19: Box Elder County Landslides Other Facilities at Risk (Active Landslides Only)

Jurisdiction Name	Critical Facilities	Roads	Power lines	Rail Lines
Willard City		.6 miles Interstate/ $18 million 3.5 miles two land/ $10.8 million	0.6 miles 138 Kv line/$28,760	
Unincorporated		.1 miles Interstate/ $3 million	.2 miles 138Kv line/$9,586	

See Appendix D for data sources and cost factors.
Note: Jurisdictions not listed have no identified facilities at risk. Data does not include areas susceptible to debris flows (no data available)

Assessing Vulnerability: Analyzing Development Trends

Any development on alluvial fans in the South Willard area could be problematic.

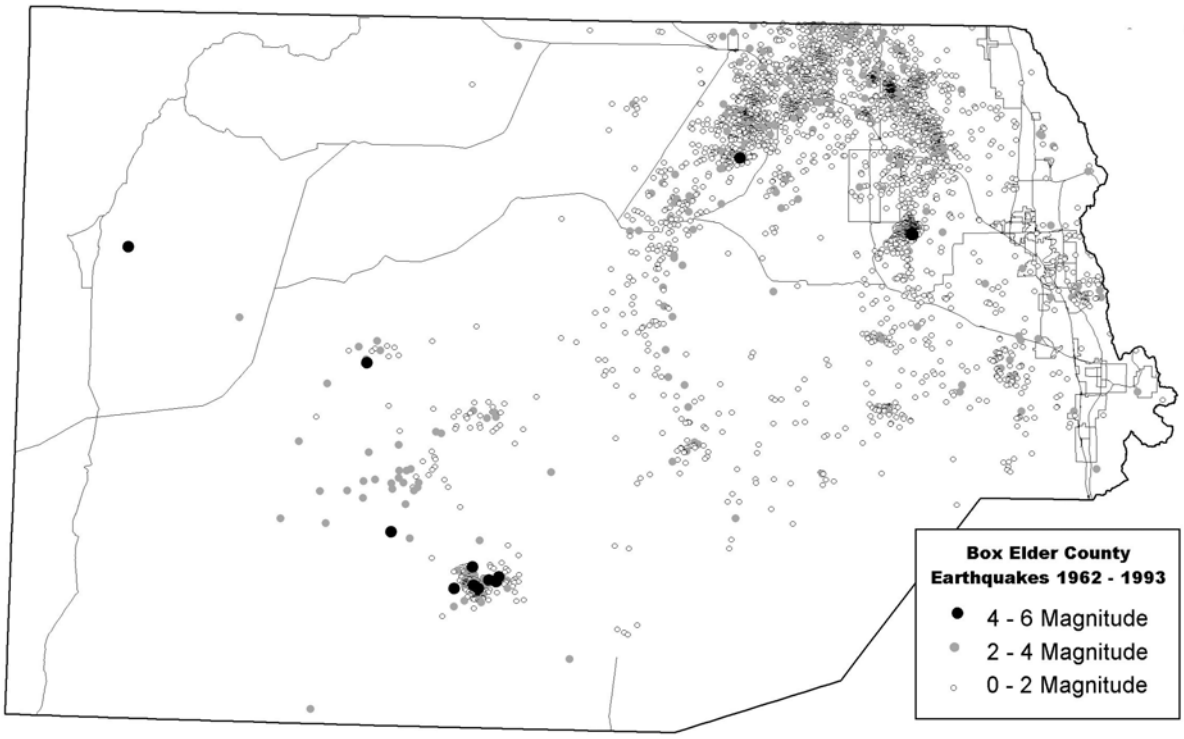
BOX ELDER COUNTY EARTHQUAKES

Background

The most populated portions of Box Elder County are located on the Intermountain Seismic Belt and the northern most segment of the Wasatch Fault. Earthquakes are common in Box Elder County, although no major earthquake resulting in significant property damage has occurred since European settlement. Geologic evidence establishes the possibility of a major earthquake in Box Elder County. **See the "Earthquake Fault Zone" and "Liquefaction Potential" Map in the county annex map section.**

History of Earthquakes in Box Elder County

The 1934 Hansel Valley Earthquake at 6.54 magnitude is widely held as the state's largest earthquake in modern recorded history (four aftershock earthquakes occurred ranging from 4.8 to 6.1 magnitude). The epicenter was in a largely unpopulated portion of the county and little or no property damage occurred. This earthquake resulted in surface fault rupture. Prior, in 1909 a 6.0 magnitude earthquake also occurred in the Hansel Valley.



Box Elder County Earthquake Hazard Assessment
Hazard Profile

Frequency	Low magnitude events occur frequently. Larger magnitude events are rare (although not necessarily on geologic time).
Severity	Potentially Catastrophic
Location	Entire County with highest frequency north of the Great Salt Lake. Surface fault ruptures are likely to occur in fault zones and liquefaction would impact most of the populated county.
Seasonal Pattern	None
Duration	A few minutes with potential aftershocks
Speed of Onset	No warning
Probability of Future Occurrences	Based on 1962-1993 data, there is a 50% chance every year of an earthquake of 4.0 magnitude or greater.

Much of the populated corridor in Box Elder County is located near the Wasatch Fault. According to Hecker (1992), the Wasatch Fault Zone is the longest and most active normal fault in the Utah. The Wasatch Fault extends from the south of Malad Idaho to western Sanpete County Utah, much along the populated Wasatch Front. Ten distinct segments have been identified along the fault that has similar characteristics.

Based on geologic evidence of the last 6000 years, of all the studied segments the Brigham City segment through most of Box Elder County is the most overdue for seismic release. Evidence suggests that it has been at least 3000 years since a significant release has occurred on the Brigham fault segment. All the other studied segments of the fault indicate faulting in the last 3000 years which suggests these segments have had release of seismic energy (Hecker, 1992).

Development in portions of **Brigham City, Perry, Honeyville and Willard** are located in areas that are susceptible to surface fault rupture in the event of a large earthquake.

Soil liquefaction presents the most widespread threat to **Box Elder County** inhabitants. Like most of the populated Wasatch Front, much of the population in Box Elder County is located on lake bed sediments from ancient Lake Bonneville. In addition areas with higher groundwater and more sandy soils present the highest risk. Problems related to soil liquefaction would impact a large percentage of the population in the event of a 5+ magnitude earthquake.

Assessing Vulnerability: Identifying Assets & Estimating Losses

Table IV-20: Box Elder County Earthquake Risk (Liquefaction) Residential and Commercial

Jurisdiction Name	Population	Residential Development at Risk		Commercial Development at Risk (x 1000)	
		Units	Value	Units	Income*/Structures**
Bear River City	750	233	$28,752,286	14	$7,600/$4,802
Brigham City	1,210	370	$44,449,661	90	$240,500/$30,876
Corinne City	619	206	$21,341,700	9	$13,000/$3,087
Deweyville Town	241	93	$13,167,183	2	$600/$686

Table IV-20: Box Elder County Earthquake Risk (Liquefaction) Residential and Commercial					
Jurisdiction Name	**Population**	**Residential Development at Risk**		**Commercial Development at Risk (x 1000)**	
		Units	**Value**	**Units**	**Income*/Structures****
Elwood Town	681	198	$26,823,488	7	$9,900/$2,401
Fielding Town	448	142	$15,765,197	8	$6,500/$2,744
Garland City	1,911	609	$31,668,000	34	$19,000/$11,664
Honeyville City	421	136	$17,335,932	16	$21,700/$5,489
Perry City	193	58	$8,688,271	1	$900/$343
Tremonton City	5,405	1,758	$193,749,291	241	$ 408,600/$82,679
Willard City	264	85	$10,460,115	9	$32,200/$3,087
Unincorporated	4,920	1,550	$186,181,315	133	$214,000/$45,628

Population and Residential Development estimates are derived using 2000 Census data
*****2002 estimated total sales revenue (Census)
** Based on average 2002 assessed commercial building value for Box Elder County
(2002 State Tax Commission Report & Box Elder County Assessor's Office)
Note: Communities not listed have no residential or commercial property identified in the hazard.

Table IV-21: Box Elder County Earthquakes (Liquefaction) Other Facilities at Risk				
Jurisdiction Name	**Critical Facilities**	**Roads**	**Power lines**	**Rail Lines**
Bear River City	School	12.2miles/$37,820,000		
Brigham City	Discovery School	2.2miles Interstate/$66,000,000 17.2miles 2 lane/$53,320,000		7.06miles/$1,702,413
Corinne City	Fire Station	19.0miles/$58,900,000		4.23miles/$1,020,001
Deweyville Town		4.8miles/$14,880,000		4.06miles/$979,008
Elwood Town		3.6miles Interstate/$1.8,000,000 25.3miles/$78,430,000		3.32miles/$800,568
Fielding Town	Fire Station & School	8.0miles/$24,800,000		
Garland City	Middle School, Police Station, High School	1.27miles Interstate/$36,000,000 10.7miles 2 lane/$33,170,000		1.99miles/$479,859
Honeyville City	Fire Station	6.6miles Interstate/$198,000,000 17.4miles 2 lane/$53,940,000	2.8miles 345Kv line/$134,999 4.9miles 138Kv line/$233,877	7.01milles/$1,690,356
Howell Town				
Mantua Town				
Perry City		2.9miles Interstate/87,000,000 0.2miles 2 lane/$620,000	0.5miles 345Kv line/$24,107 1.0 miles 138Kv line/$47,934	3.74miles/$901,845
Tremonton City	North Park School, BRV Hospital, Fire/Police station, McKinley School	4.7miles Interstate/$41,000,000 27.7miles 2 lane/$85,700,000		3.88miles/$935,604
Willard City		4.37miles Interstae/$129,000,000	2.7miles 345Kv line/$130,178	4.76miles/$1,147,803

Table IV-21: Box Elder County Earthquakes (Liquefaction) Other Facilities at Risk				
Jurisdiction Name	**Critical Facilities**	**Roads**	**Power lines**	**Rail Lines**
		12.9miles 2 lane/$39,990,000	7.4miles 138Kv line/$354,711	
Unincorporated		29.6miles Interstate /$880,000,000 238miles 2 lane/$737,8000,000	17.9miles 345Kv line/$63,030 3.2miles 230Kv line/$154,432 46miles 138Kv line/$2,209,757	42.84miles/$10,330,223
See Appendix D for data sources and cost factors. **Note: Jurisdictions not listed have no identified facilities at risk.**				

Table IV-22: Box Elder County Earthquake Risk (Fault Zone) Residential and Commercial					
Jurisdiction Name	**Population**	**Residential Development at Risk**		**Commercial Development at Risk (x 1000)**	
		Units	**Value**	**Units**	**Income*/Structures****
Brigham City	715	208	$23,770,185		
Honeyville City	30	10	$1,149,286		
Perry City	14	5	$726,861		
Unincorporated	39	11	$1,558,940		
Population and Residential Development estimates are derived using 2000 Census data *****2002 estimated total sales revenue (Census) ** Based on average 2002 assessed commercial building value for Box Elder County (2002 State Tax Commission Report & Box Elder County Assessor's Office) **Note: Communities not listed have no residential or commercial property identified in the hazard.**					

Table IV-23: Box Elder County Earthquakes (Fault Zone) Other Facilities at Risk				
Jurisdiction Name	**Critical Facilities**	**Roads**	**Power lines**	**Rail Lines**
Deweyville Town			0.1miles/$4,793	
Perry City				.74miles/$178,440
Unincorporated			0.1miles 345Kv line/$4,821 0.2miles 230Kv line/$9,662 0.9miles 138Kv line/$43,141	.87miles/$209,787
See Appendix D for data sources and cost factors. **Note: Jurisdictions not listed have no identified facilities at risk.**				

Box Elder County HAZUS Analysis

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates can be used by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The results of the model ran for Box Elder County simulates a 2,500 year event with an earthquake magnitude of 7.0.

Table IV-23: Box Elder County Human Casualty Estimates (HAZUS Model 7.0 Magnitude Earthquake)

Timing	Sector	Level 1	Level 2	Level 3	Level 4
2 A.M	Commercial	2	1	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	1	0	0	0
	Industrial	5	2	0	0
	Residential	77	19	2	4
	Single Family	292	75	10	20
	Total	378	98	13	25
2 P.M.	Commercial	183	57	10	19
	Commuting	0	0	1	0
	Educational	111	34	6	11
	Hotels	0	0	0	0
	Industrial	39	11	2	4
	Residential	15	4	0	1
	Single Family	60	15	2	4
	Total	407	122	20	39
5 P.M.	Commercial	173	53	9	18
	Commuting	0	0	0	0
	Educational	8	2	0	1
	Hotels	0	0	0	0
	Industrial	24	7	1	2
	Residential	29	7	1	1
	Single Family	115	30	4	8
	Total	349	100	16	30

Severity Level 1: Injuries will require medical attention buy hospitalization is not needed.
Severity Level 2: Injuries will require hospitalization buy are not considered life-threatening.
Severity Level 3: Injuries will require hospitalization and can become life threatening in not promptly treated.
Severity Level 4: Victims are killed by the earthquake.

Table IV-24: Box Elder County Building-Related Economic Loss Estimates in $ Millions (HAZUS Model 7.0 Magnitude Earthquake)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Loses	Wage	0.00	.63	9.21	.45	.41	10.70
	Capital-Related	0.00	.27	8.08	.26	.15	8.76
	Rental	12.66	5.33	5.02	.19	.19	23.40
	Relocation	1.14	.12	.23	.01	.06	1.57

Table IV-24: Box Elder County Building-Related Economic Loss Estimates in $ Millions (HAZUS Model 7.0 Magnitude Earthquake)							
Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
	Subtotal	13.81	6.35	22.54	.91	.81	44.43
Capital Stock Loses	Structural	63.54	8.31	15.66	2.71	3.02	93.23
	Non-structural	223.05	38.39	41.57	9.68	7.63	320.32
	Content	52.40	7.83	18.76	6.11	3.50	88.60
	Inventory	0.00	0.00	.72	.96	.10	1.79
	Subtotal	338.80	54.53	76.70	19.47	14.25	503.94
	Total	352.80	60.88	99.25	20.38	15.07	548.37

Table IV-25: Box Elder County Transportation System Loss Estimates in $ Millions (HAZUS Model 7.0 Magnitude Earthquake)			
System	Component	Inventory Value	Economic Loss
Highway	Segments	1,731	0
	Bridges	195	42
	Subtotal	1,926	42
Railways	Segments	279	0
	Bridges	0	0
	Subtotal	279	0
Airport	Facilities	16	6
	Runways	91	0
	Subtotal	107	6
	Total	2,312	48

Table IV-26: Box Elder County Transportation System Loss Estimates in $ Millions (HAZUS Model 7.0 Magnitude Earthquake)				
Classification	Total	Least Moderate Damage > 50%	Complete Damage > 50%	Functionality >50% at day 1
Hospitals	2	2	0	0
Schools	27	16	0	1
Police Stations	6	3	0	0
Fire Stations	6	5	0	0
On the day of the earthquake the model estimates that only 5% of the hospital beds in the county would be available for patient use. After 30 day 72% of the beds are predicted to be operational.				

Table IV-27: Box Elder County Expected Building Damage by Occupancy (HAZUS Model 7.0 Magnitude Earthquake)										
	None		Slight		Moderate		Extensive		Complete	
	Count	%	Count	%	Count	%	Count	%	Count	%
Agriculture	0	.03	1	.01	1	.01	0	.02	0	.02
Commercial	4	.26	8	.24	21	.46	20	1	16	1.6

Table IV-27: Box Elder County Expected Building Damage by Occupancy (HAZUS Model 7.0 Magnitude Earthquake)										
	None		Slight		Moderate		Extensive		Complete	
	Count	%	Count	%	Count	%	Count	%	Count	%
Education	0	0	0	0	0	0	0	0	0	0
Government	0	.01	0	.01	1	.01	1	.03	0	.05
Industrial	1	.06	2	.05	4	.09	4	.23	3	.31
Religion	0	0	0	0	0	.01	0	.02	0	.02
Residential	50	3	150	4	339	7	326	18	216	22
Single Family	1,410	96	3,313	95	4,283	92	1,456	80	745	76
Total	1,465		3,474		4,649		1,808		980	

Assessing Vulnerability: Analyzing Development Trends

The development trend for many cities in Box Elder County has been to build further up in the foothills of the Wellsville and Willard Mountains. As cities get more “built-out” this trend will likely increase. This development will be exposed to risk associated with potentially unstable slopes or surface fault rupture in the event of an earthquake. New growth pressure in South Willard is of particular concern.

BOX ELDER COUNTY DAM FAILURE

Background

There are 261 regulated dams located in Box Elder County. Most of these dams are small detention ponds or livestock watering facilities and most pose a minimal threat to human safety or property.

Of the 261 regulated dams 250 are designated as “low hazard” by the State of Utah Division of Water Rights. As defined by state statue, low hazard dams are those dams which, if they fail, would cause minimal threat to human life, and economic losses would be minor or limited to damage sustained by the owner of the structure.

A total of 7 dams have been designated as “moderate hazard” by the State of Utah in Box Elder County. Moderate Hazard dams which, if they fail, have a low probability of causing loss of human life, but would cause appreciable property damage, including damage to public utilities.

The State of Utah has rated 4 dams in Box Elder County as “high hazard” which means that, if they fail, have a high probability of causing loss of human life or extensive economic loss, including damage to critical public utilities.

Dam failure inundation maps and emergency action plans for each of the high risk dams can be found on the Utah Division of Water Right’s website at: http://waterrights.utah.gov/cgi-bin/damview.exe?Startup.

History of Dam Failure in Box Elder County

No significant dam failures have occurred in Box Elder County.

Box Elder County Dam Failure Hazard Assessment
Hazard Profile

Frequency	Rare
Severity	Potentially Catastrophic
Location	Areas down stream of failed dam.
Seasonal Pattern	Anytime. Highest risk in spring during snowmelt.
Duration	A few hours
Speed of Onset	No warning
Probability of Future Occurrences	Low

Assessing Vulnerability: Identifying Assets & Estimating Losses

Blue Creek Dam
The Blue Creek Dam is located one mile north of the town of Howell and has a hazard rating of high. The inundation area flows southward along blue creek, then just west of the development in Howell before ending at the Great Salt Lake basin.

Mantua Dam
The Mantua reservoir and dam have a high hazard rating. The inundation area covers the entire western side of the dam including significant amounts of the town of Mantua. Within the town, multiple homes and structures are at risk. The inundation continues westerly down Box Elder Creek filling the canyon bottom and covering highway 89/91, eventually leading through the center of Brigham City. Once again, significant numbers of people, homes and businesses are within the potential inundation area.

Three Mile Creek (debris and detention basin)
Three Mile Creek retention basin is located about 0.5 miles southwest of the city of Perry. The inundation area flows westerly from the dam towards the Great Salt Lake basin. Several structures as well as a section of highway 89/91 lie within the inundation area.

Cutler Dam
Cutler Dam and reservoir lie in extreme western Cache County and about four miles east northeast of Fielding in Box Elder County. This facility has a hazard rating of high. The inundation area follows the Bear River flood plain first southwesterly and then south past Deweyville, Elwood, Honeyville, Bear River City and finally Corrine City before ending at the Great Salt Lake. Since the inundation area remains, for the most part, within the flood plain, threats the population and homes appears to be minimum.

Assessing Vulnerability: Analyzing Development Trends

Any new downstream development that is located in the floodplain increases the exposure to risk in terms of human life and property. Given the relatively low probability of catastrophic dam failures, most jurisdictions are unwilling to regulate development in dam failure inundation areas.

BOX ELDER COUNTY HAZARD MITIGATION STRATIGIES

Hazard Mitigation Goals

The following goals were identified to direct the county's hazard mitigation strategies. These general goals were identified and developed based on the local official surveys (See appendix A), input from the Bear River District PDM Technical Planning Team and Steering Committee.

Goal # 1: Minimize potential impacts for future development

- **Develop, refine and improve the hazard data available to local level decision makers.**
- **As appropriate, develop and implement regulatory mechanisms to insure new development activities will not increase the risk to life or property.**
- **Build technical capacity for local elected and appointed officials.**
- **Empower citizens to make informed choices.**

Goal # 2: Minimize potential impacts for existing development

- **Improve emergency disaster response capabilities.**
- **Improve the disaster resistance of existing infrastructure and critical facilities.**
- **Educate and build capacity of citizens to undertake mitigation activities.**

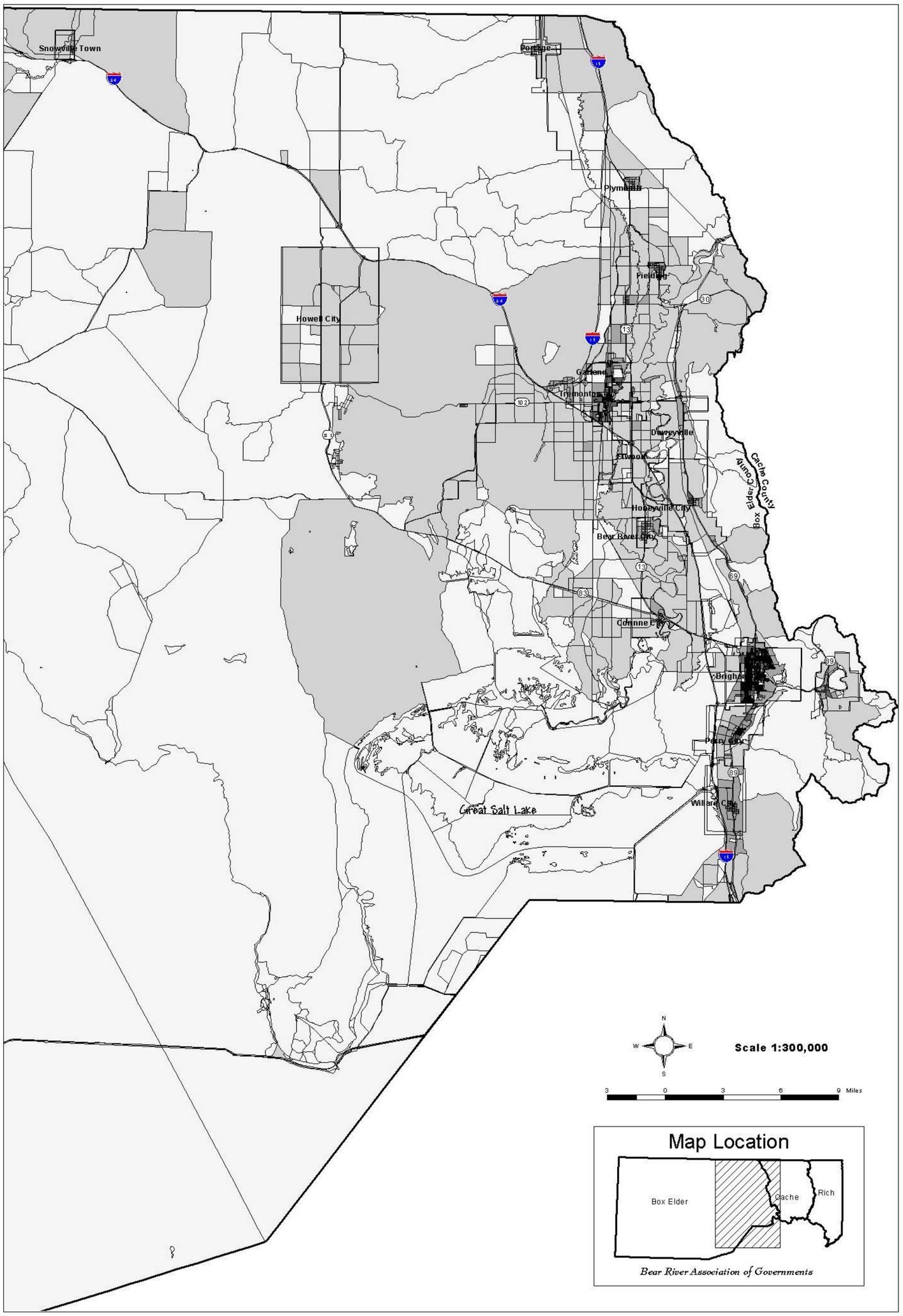
To accomplish these goals specific mitigation strategies were developed by participating jurisdictions. These goals were given assigned a priority of high, medium, or low by Bear River District PDM Technical Planning Team and Steering Committee. Priorities were give taking into account the following factors:

- Number of people protected by the project
- Technical feasibility
- Political support
- Environmental impacts
- Available funding source

A guiding factor in prioritizing mitigation was the though that mitigation should provide the greatest amount of good to the greatest amount of people when cost was taken into account. Prioritizing mitigation was difficult in this plan as each as Bear River is vulnerable to many different hazards. Each with its own characteristics. Thus, recurrence intervals, past events, damage estimates compiled during the assessing vulnerability section of this plan were also taken into account.

BOX ELDER COUNTY NATURAL HAZARD MITIGATION PROJECTS Bear River District Pre-Disaster Mitigation Plan 2004									
Hazard	**Goal**	**Jurisdiction(s)**	**Objective**	**Project Description**	**Priority**	**Timeframe**	**Potential Funding**	**Estimated Cost**	**Resources**
Multi-Hazard	**Goal 2**	**All Jurisdiction**	**Prepare for Severe Weather Events**	**Become a National Weather Service "Storm Ready" Community (http://www.stormready.noaa.gov/)**	**Medium**	**2006**		**Minimal**	**NOAA**
Multi-hazard	**Goal 1 & 2**	**Brigham, Mantua**	**Protect critical infrastructure**	**Bury the 36" Penstock water line that carries culinary water, produces power and provide irrigation water to Brigham City.**	**High**	**2007**	**Local, FEMA**		
Multi-hazard	**Goal 1 & 2**	**Perry City**	**Improve emergency preparedness**	**CERTS training and equipment**	**High**	**2006**	**Local, FEMA**	**$3,000-$5,000**	**UDESHS, FEMA**
Multi-hazard	**Goal 1 & 2**	**Perry City**	**Protect critical infrastructure**	**Install electrical generators at culinary water wells.**	**High**	**2005**	**Local, FEMA**	**$20,000**	**UDESHS, FEMA**
Flooding	**Goal 1 & 2**	**Snowville, Plymouth and Tremonton**	**Mitigate impacts related to flooding.**	**Initiate participation in the National Flood Insurance Program (NFIP) to enable home owners to purchase flood insurance.**	**High**	**2005**		**Minimal**	**UDESHS, ACOE**
Flooding	**Goal 1 & 2**	**Jurisdictions with identified flood hazards**	**Make better informed decisions.**	**Develop a floodplain map for communities that do not have one. Refine, update and improve existing flood plain mapping.**	**Medium**	**2009**	**FEMA, UDESHS, Local**	**$2,500 to $65,000 each**	**Consultants, FEMA, UDESHS, Public Works**
Flooding	**Goal 1 & 2**	**Brigham City, Perry, Willard**	**Minimize flood risk from canal failure or overtopping**	**For those not already been studied, analyze and model the canals to determine deficiencies related to present and future demands (taking into account projected storm water increases based on projected development).**	**Medium**	**2007**	**Local, FEMA**	**$40,000**	**Consultants**
Flooding	**Goal 2**	**Perry, Willard**	**Minimize flooding along the base of the Willard Mountains (Perry south to Weber County Boundary).**	**Pearson Canyon drainage-extend storm water drain west of SR-89 to the east of the railroad tracks and eventually under the tracks to wetlands.**	**Medium**	**2005**	**Willard City, Willard Flood Improvement District, FEMA**	**$106,100**	
Flooding	**Goal 2**	**Willard**	**Minimize flooding along the base of the Willard Mountains (Perry south to Weber County Boundary).**	**Pearson Canyon drainage-dike the north channel east of the Ogden-Brigham Canal to divert water to the south branch. Deepen existing detention basin and low level outlet constructed.**	**Medium**	**2007**	**Willard City, Willard Flood Improvement District, FEMA**	**$126,000**	
Flooding	**Goal 2**	**Tremonton**	**Protect critical community facilities.**	**Berm around the west and north sides of the regional waste water treatment plan (similar to south and east sides). 840 feet, 3 feet high and 15 feet wide along Malad River.**	**Medium**	**2006**	**Tremonton, FEMA**	**$12,000**	
Flooding	**Goal 2**	**Honeyville**	**Educate citizens**	**Provide education and issue warnings when building permits are issued along the Bear River.**	**High**	**2004**	**Honeyville Town**	**Minimal**	
Flooding	**Goal 2**	**Honeyville**	**Educate citizens**	**Educate citizens and property owners along foot of Wellsville Mountains of areas of past flooding.**	**High**	**2004**	**Honeyville Town**	**Minimal**	
Wildfire	**Goal 2**	**Honeyville, Deweyville, Brigham City, Perry, Willard**	**Become "Firewise" communities.**	**Enact ordinance and planning procedures to insure development in fire prone areas are done wisely. Provisions for multiple access routes, firebreaks, wide roads and adequate water sources should be included. Standards for homes should be enforced that require defensible space and fire wise building materials and designs (see www.firewise.org).**	**High**	**2007**		**Minimal**	**BRAG, Utah Division of State Lands, Fire and Forestry, Utah League of Cities and Towns.**
Wildfire	**Goal 2**	**Honeyville**	**Build citizen capacity**	**Educate and train property owners along the foot of the Wellsville Mountains about living with wildfire threats.**	**High**	**2006**	**Honeyville Town**	**Minimal**	**BRAG, Utah Division of State Lands, Fire and Forestry, Utah League of Cities and Towns.**
Earthquake and Landslide	**Goal 1 & 2**	**All Jurisdictions**	**Make better informed decisions.**	**Improve the geologic hazard information and mapping for populated portions of the county.**	**Medium**	**2008**	**Utah Geologic Survey, Local**	**$65,000**	**Utah Geologic Survey, BRAG**
Earthquake and Landslide	**Goal 1**	**All Jurisdictions**	**Avoid placing new development at risk from geologic hazards.**	**Develop land use ordinances that require site specific geo-hazard studies be performed prior to development permitting in areas determined to be high risk related to earthquakes (especially for critical or high-occupancy buildings).**	**High**	**2006**		**Minimal**	**Utah Geologic Survey, BRAG, Utah League of Cities and Towns.**

PART IV-BOX ELDER COUNTY ANNEX HAZARD MAPPING



Box Elder County

Population Density

Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County Boundries fand population density from US Census.

Roads

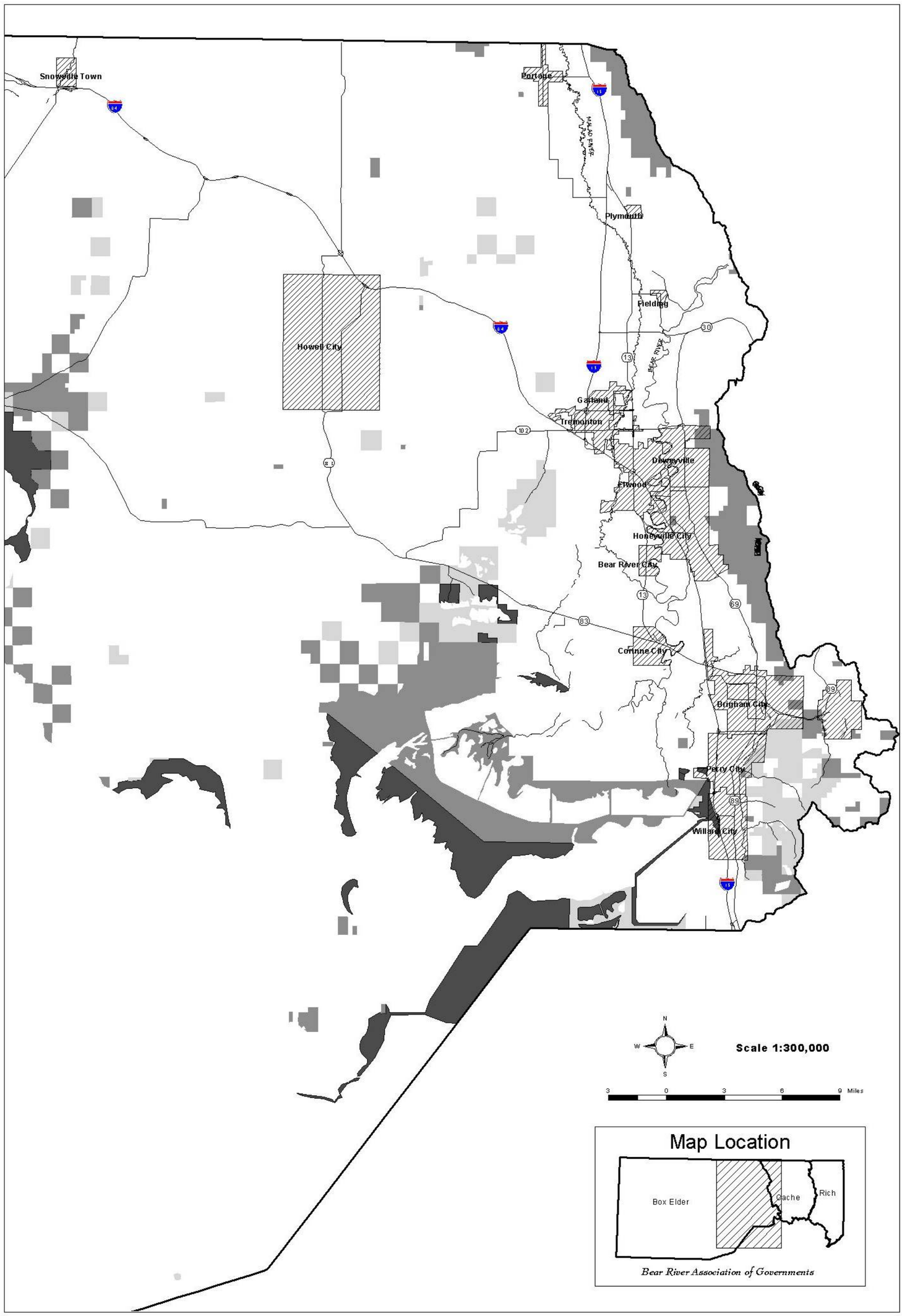
Rivers

Box Elder County

Population Density
(Persons per acre)

- 0
- 0 - 0.3
- 0.301 - 2
- 2.001 - 6
- 6.001 - 1000

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich



Box Elder County

Land Ownership

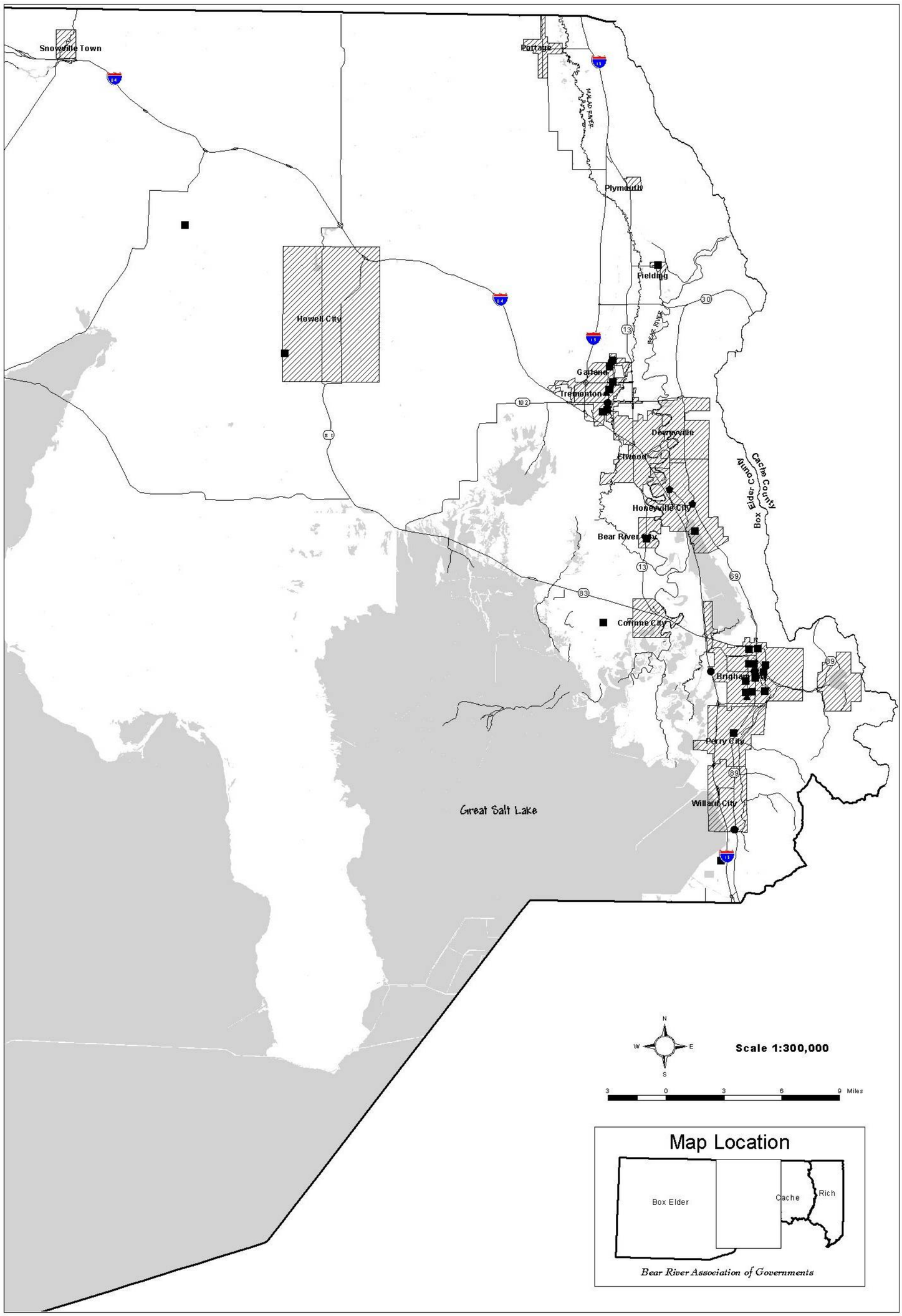
Data Source: Municipalities, ownership, roads, rivers and lakes maintained by Utah AGRC. County Boundries from U.S. Bureau of the Census.

The information on this map was derived from digital databases from BRAG GIS. Care was taken in the creation of this map but is provided "as is." BRAG cannot accept any responsibility for any errors, omissions, or positional accuracy, and therefore, there are no warranties which accompany this product. Although information from a land survey may have been used in the creation of this product, in no way does this product represent a Land Survey. Users are cautioned to field verify information in this product before making any decisions.

Roads
Rivers
Cache County
Municipalities

Land Ownership
Private
State Lands
Federal Lands
Sovereign Lands

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich



Box Elder County

Critical Facilities

Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County Boundries from US Census.

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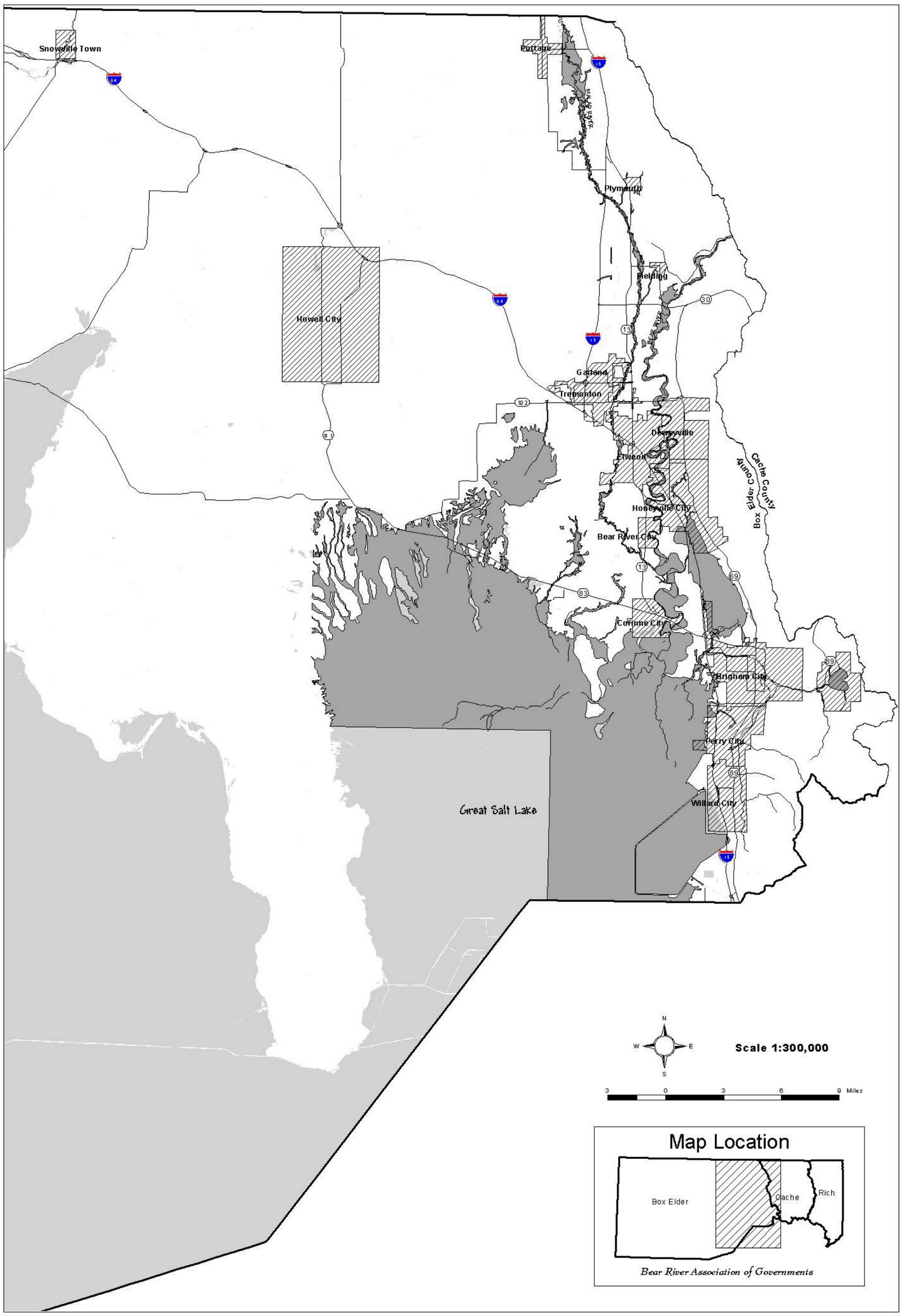
- Roads
- Rivers
- Lakes
- Municipalities
- Police Station
- School
- Hospital
- Fire Station
- Box Elder County

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich



Box Elder County

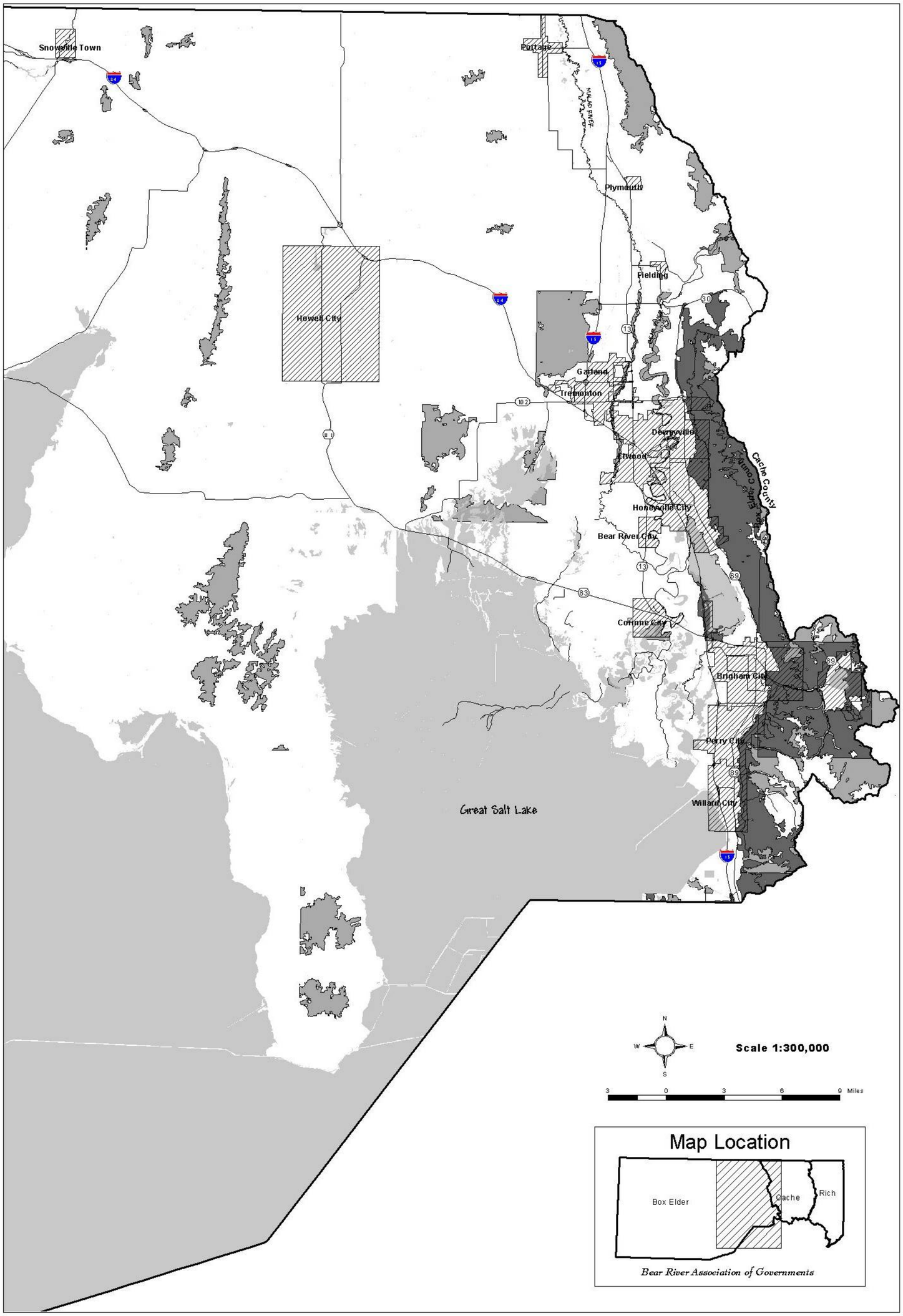
FEMA Flood Zone

Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County Boundries from US Census. FEMA Flood Zone digitized from paper FIRM maps.

The information on this map was derived from digital databases from BRAG GIS. Care was taken in the creation of this map but is provided "as is." BRAG cannot accept any responsibility for any errors, omissions, or positional accuracy, and therefore, there are no warranties which accompany this product. Although information from a land survey may have been used in the creation of this product, in no way does this product represent a Land Survey. Users are cautioned to field verify information in this product before making any decisions.

Roads
Rivers
Lakes
FEMA Flood Zone
Municipalities
Box Elder County

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich



Box Elder County

Wildfire Hazard

Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County Boundries from US Census. Fire Classes from BLM Fire Hazard Analyisis.

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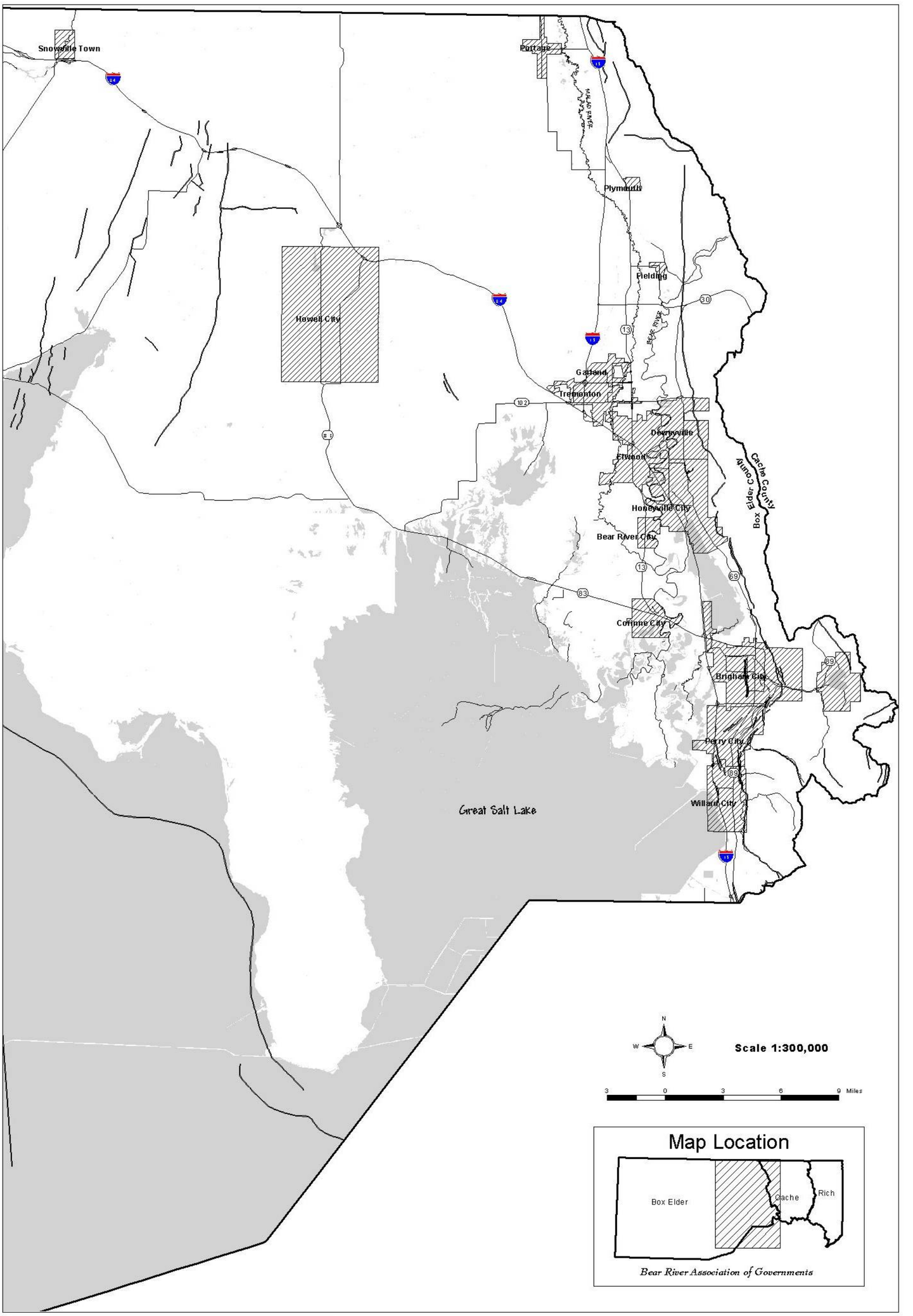
- Roads
- Rivers
- Lakes
- Municipalities
- Moderate Fire Hazard
- High and Extreme Fire Hazard
- Box Elder County

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich

Landslide Missing



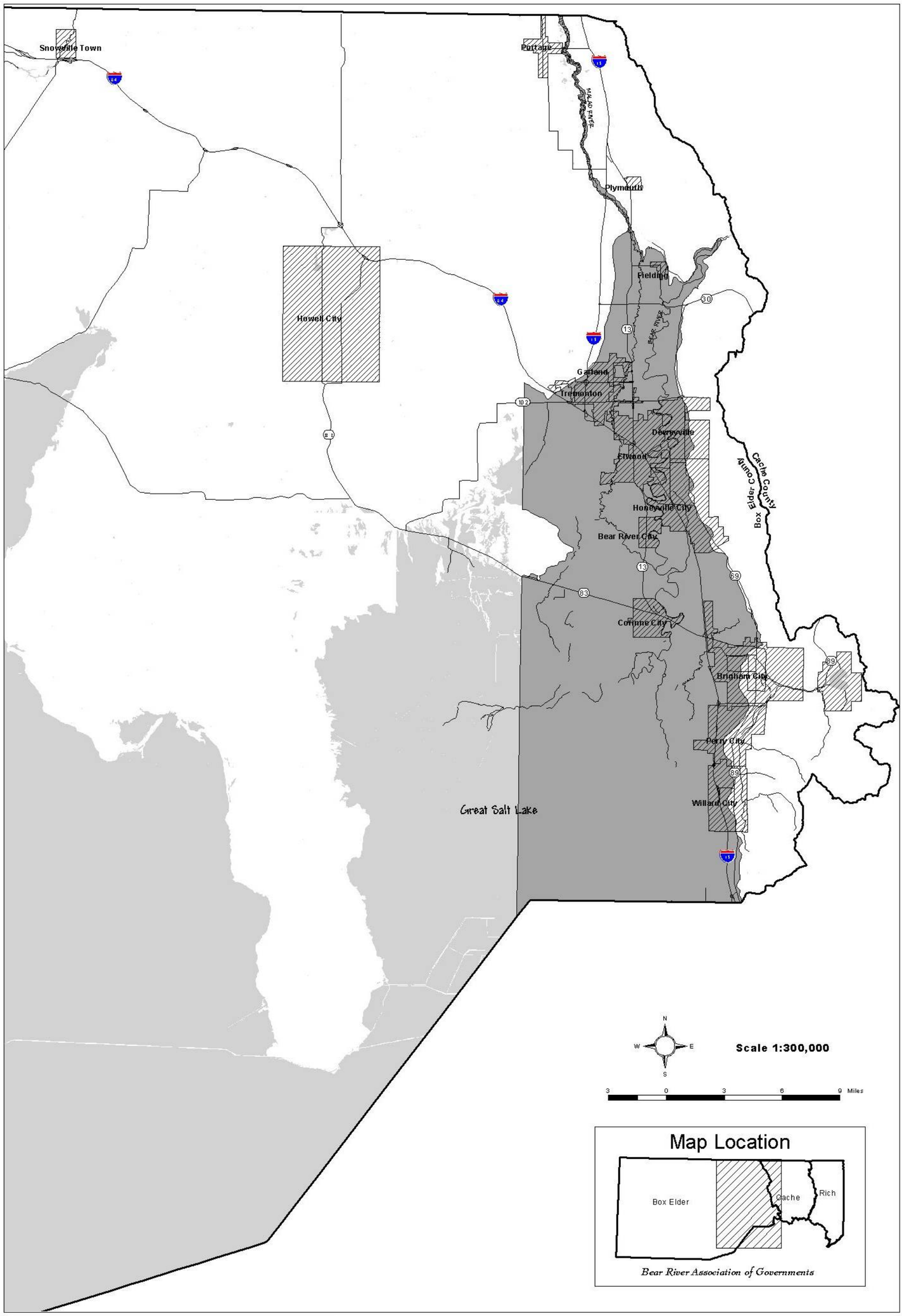
Box Elder County

Earthquake Fault Zone

Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County Boundries from US Census. Fault zones derived from "Quaternary Tectonics of Utah" (Hecker, Utah Geological Survey Bulletin 127, 1993)

Roads
Rivers
Lakes
100' Fault Zone
Municipalities
Box Elder County

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich



Box Elder County

Liquifaction Potential

Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County Boundries from US Census.

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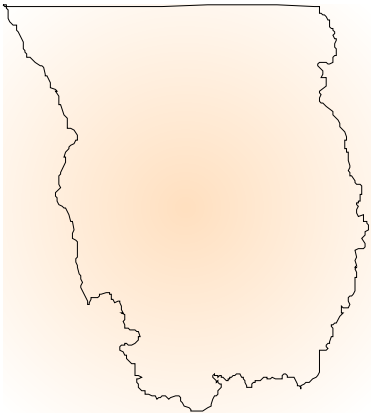
Roads
Rivers
Lakes
High Liquifaction
Municipalities
Box Elder County

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich

PART IV-CACHE COUNTY ANNEX RISK ASSESSMENT



General Background Information

Cache County is located in extreme Northern Utah and is bordered by Box Elder County to the west and Rich County on the east. The County, covering roughly 1,165 square miles of land, is nestled between the Bear River Mountain's to the east and the divide of the Wellsville Mountains on the west. Cache Valley, a fertile agricultural area characterized by hundreds of farms and dairies, extends to the foothills of these ranges.

Cache County gained its name from the fur trading days when trappers such as Jim Bridger and Eteinne Post trapped beaver along the Bear and Logan Rivers and "cached" their pelts in large holes that they dug throughout the area. Settlement of the area began around 1855 when Brigham Young sent Mormon families to establish settlements in the valley. Since the wild grass was ideal for grazing, twenty-three men and two women were sent to Cache Valley to begin a cattle ranch on the Blacksmith Fork River. It was named Elkhorn Ranch after the antler hanging over the main gate. The plans were for 3,000 cattle to remain in the valley during the summer, and then winter further south in warmer climates. Unfortunately, the winter snows fell early that year. In a desperate attempt to save the cattle from the cold, the ranchers drove them to Box Elder County in a raging blizzard. The snow drifts were four feet deep in the valley and even deeper in the mountains. One of the rancher's feet froze and only 420 cattle survived. Within two years these ranchers left Cache Valley.

The early settlers of Elkhorn Ranch and the later Maughan's Fort weren't the first people to live in Cache Valley. Shoshoni Indians hunted and fished in "Willow Valley," as it was first called for the great willow trees that lined the stream and river banks.

In the early 1900's the fertile soil in Cache Valley attracted further settlement and soon transformed the valley into a major agricultural center for farming and ranching. Today, agriculture is still a viable part of Cache County's economy as evidenced by numerous farms, ranches, and dairy operations along with cheese factories and beef and pork processing plants. Utah State University located in Logan City has long been a significant part of the valley's economy and continues to grow as a major research university and area employer. Recent economic development includes several light manufacturing firms that have increased employment opportunities and a growing tourism industry which takes advantage of the County's countless scenic and outdoor recreation opportunities. (See the “Population Density and “Land Ownership” map in the map section of the county annex)

Table IV-28: Cache County Participating PDM Jurisdictions			
Cache County	Amalga Town	Clarkston Town	Cornish Town
Hyde Park City	Hyrum City	Lewiston City	Logan City
Mendon City	Millville City	Newton Town	Nibley City
North Logan City	Paradise Town	Providence City	Richmond City
River Heights City	Smithfield City	Trenton Town	Wellsville City

CACHE COUNTY FLOODING

Background

Portions of Cache County are at threat from both riverine and flash flooding. The Cache Valley (the western part of Cache County where nearly all the county's population is located) is located in the Bear River Drainage basin. The Bear River flows through the valley. The two main tributaries of the Bear River located in Cache County are the Logan and Blacksmith Fork Rivers. The Logan River is the largest tributary of the Bear. Other tributaries of the Bear that generally enter the valley through canyons of the mountainous eastern part of the county are the Summit Creek, Little Bear, Spring Creek Cherry Creek, High Creek and the Cub River All of these steams and rivers, to some degree, have had some history of flooding.

Phase II of the National Pollutant Discharge Elimination System (NPDES) administered by EPA has requirements for communities to more carefully manage their storm water discharge. While driven more by water quality concerns, nonetheless this provides an important opportunity for communities to better manage their storm water systems. This is critically important because for many communities an ever increasing threat to residents comes from the potential for man-made canal failure flooding. As more development has occurred, existing irrigation canals have been increasingly relied on to accommodate storm water discharge. Irrigation officials are quick to point out that the canals were never designed for such use. Most canals have lower capacities and a narrowing channel the further you go down the canal. While this design makes sense for irrigation use, it is exactly the opposite of how you would design a canal to accommodate storm water discharge. The positions of many canals in Cache County also make them susceptible to blockage by debris or ice that can result in canal failure outflows. Cache County has had a couple of near misses in this regard.

In terms of potential damage to developed residential, commercial and industrial areas, the Logan & Blacksmith Fork Rivers poses the most significant threat for residents of Cache County. Both of these rivers drain large areas and have steep well defined stream channels. Flood level flows are produced when high temperatures occur during the early spring and accelerate the watershed snowmelt rate. Often this threat can be escalated when combined with early spring rains.

A number of dams are located on the Logan River in the canyon upstream of the City of Logan. Due to their relatively small size, they do little to moderate flood potential for downstream development.

The Bear River enters Cache County on the north near Preston Idaho. Winding through the valley it eventually enters the Cutler Reservoir. The risk from rising flood waters of the Bear River through Cache County is relatively minor. Land located in the Bear River flood plain has a high water table which makes development difficult. Most of adjacent land near the Bear is used for agricultural purposes. Farmers and ranchers have seemingly adapted their agricultural activities to mitigate the cyclical high flows effects of the Bear River. Much of the adjacent agricultural uses along the Bear are operated under lease agreements with Pacificorp who owns

most of Cutler Reservoir. **See the "FEMA Flood Zone" Map in the county annex map section.**

History of Flooding in Cache County

In terms of historical flooding impact on development, most events have been documented on streams and rivers that drain the mountainous eastern portion of Cache County and flow into western Cache Valley. Most of the significant flooding that has historically impacted developed land has occurred on the Logan and Blacksmith Fork Rivers. However, noteworthy flooding has occurred on some of the smaller streams and creeks that enter the valley near the towns of Providence, Smithfield and Richmond.

Table IV-29: Cache County Flood History 1847-2003

Location	Date	Description
Amalga	1980	No information available
Clarkston	1917	No information available
	Aug 1958	Crop damage, road damage
	Aug 1961	Crop & road damage, flooded homes
	1980, 1981	No information available
Hyde Park City	1993	Lower Canal failure, home flooded and property damage.
Logan	1882	No information available
	May 1907	Logan River flooding, basements of homes near river flooded. Most flooding in Logan's recorded history.
	May 1957	Agricultural flooding in lower fields
	May 1958	Crop and road damage
	July 1962	Crop damage
	Sept 1963	Road damage
	June 1964	Crop damage, 2 inches rain in 24 hours
	1969	No information available
	1971	Low lying farms flooded, stream banks eroded, basements flooded.
	1972, 1976	No information available
	1977	Dry Canyon Flooding
	1978, 1980, 1981	No information available
	Spring 1983	Several bridges destroyed, undercutting of embankments, Canyon Road Landslide, culverts and roads.
	Aug 1997	Dry Canyon flash flooding
	1998	Flooding on the Blacksmith Fork River backed up Spring Creek and property damage occurred.
Providence	Aug 1959	Cloudburst flooding of dozens of homes near Spring Creek.

Table IV-29: Cache County Flood History 1847-2003		
Location	Date	Description
Smithfield	June 1964	A number of homes flooded by Summit Creek after intense storm
FEMA Flood insurance study for Logan City, 2-17-81, Local Surveys (see appendix A) (Butler & Marsell, 1972), (Division of Comprehensive Emergency Management, 1981)		

Cache County Flood Hazard Assessment
Hazard Profile

Frequency	Some flooding occurs nearly every year in Cache County
Severity	Moderate
Location	Generally along rivers, streams and canals.
Seasonal Pattern	Spring flooding as a result of snowmelt. Mid-late summer cloudburst events.
Duration	A few hours or up to three weeks for snowmelt flooding
Speed of Onset	1-6 hours
Probability of Future Occurrences	High-for delineated flood plains there is a 1% chance of flooding in any given year.

Isolated flooding has been fairly common for many years. Damage from flooding has been relatively minor. The majority of flooding in Cache County has occurred on agricultural land.

Following a development pattern not unlike many Utah and western communities, many early European settlements in Cache County were located near the mouths of canyons. Early settlers located there for easy access to water that could be diverted for irrigation of crops and pastures as well as fertile soils well suited for agriculture. Richmond, Smithfield, Logan, Providence Millville and Hyrum are all located near the mouths of canyons that drain some portion of the adjacent Bear River Range. The Logan River has the largest drainage basin next to the Bear at 524 square miles. The Blacksmith Fork drainage basin is the next largest at roughly 287 square miles.

Analysis of areas of Cache County mapped by FEMA for communities that participate in the NFIP indicate some conflict related to existing development located in what has been determined to be the 100 year floodplain. Digitized floodplain maps for Cache County were overlaid on a layer of Digital Ortho Aerial Photographs as well as a 1996 data layer that delineates "developed" areas (Water Related Land use Study produced for the State of Utah Division of Water Resources). An August 2003 report Flood Hazard Identification Study: Bear River Association of Governments by the U.S. Army Corps of Engineers was also used to determine flood risk for communities that do not have FEMA Firm flood plain maps.

Hyde Park City has a number of existing homes located in the 100 year flood plain along the stream that drains Hyde Park Canyon. In addition, development near the Logan North field and Hyde Park Canals is at potential risk of flooding. The recently completed Cache County Storm Water Analysis report concluded that these canals through Hyde Park have deficient capacity to

carry predicted flows resulting from a 10 year storm event of 3 hour duration. The problem areas predicted by this model were where the canal intersects 200 South, Center Street and 300 North in Hyde Park City (JUB Engineering, 2003).

In terms of the relative hazard from flooding, older residential development along the Logan River in the lower portions of **Logan City** commonly referred to as the "Island" area represents one of the most significant threat in Cache County both in terms of potential loss of risk and property loss. A number of older homes are located in the 100 year floodplain of the Logan River. In addition a number of newer (post 1970) homes have been constructed near the river in the flood plain (along Sumac and Thrushwood Drives).

A number of homes in the Country Manor Subdivision along the Blacksmith Fork River are located in the 100 year floodplain. The Logan City Golf Course is also located in the 100 year floodplain. The golf course can accommodate flooding and flood water storage device and is designed to moderate flooding downstream.

A number of canals make their way through Logan City. Potential for failure is significant for all canals. If storm water management is not properly addressed, the risk to life and property near canals increases as more development puts further demands on systems beyond their designed capabilities. According to a canal company representative, the Northwest Field/Benson Canal experiences difficulty accommodating demand with any storm event that totals ½ inch of precipitation in one hour. The canal has a permitted flow rate of 40.3 cfs and a calculated capacity of 60 cfs. The canal has potential to pick up 363 cfs in predicted storm water flows when measured near the airport (City of Logan, 2001).

In May 1996 the Logan and Northern Canal failed above Crockett Avenue pump house. City officials were forced to divert flows down Crockett Avenue into the Logan River to prevent damage to adjacent residences (City of Logan, 2001).

A large portion of lower **Mendon Town** is mapped in the 100 year flood plain. Small streams that drain a portion of the eastern slope of the Wellsville Mountains flow through Mendon. Two steep drainages converge from Bird Canyon and Coldwater Canyon.

Perhaps a larger issue that poses a more acute flooding threat for Mendon inhabitants comes from the town's proximity to the Wellsville-Mendon Canal. Mendon is located on the lower stretches of the canal that begins at Hyrum Dam. The canal runs North-South uphill of Mendon Town. Site specific flood problems have occurred with this canal. Overtopping and bank erosion occurred in 1982. Flooding problems occurred when heavy rain fell on frozen ground.

The Lower Millville Providence Canal was demonstrated to have deficient capacities to accommodate a 10 year, 3 hour duration storm event as if flows though **Millville City** when it was modeled for the Cache County Storm Water Analysis report. Channel capacity was found to be deficient at 50 North, 150 North, 400 North and 2200 South in Millville City.

Likewise the Lower Millville Providence Canal produces similar issues as it flows though **Providence City**. The model suggest that capacity deficiency exist as the canal nears 500 South, 400 South, 200 South, 100 South and 100 North (JUB Engineering, 2003).

Residential development in **Smithfield City** along Summit Creek is also threatened by significant flooding along Summit Creek according to mapping (See Cache County Flood Plain Map). However, in post settlement history the impacts to Smithfield residence have been minimal from Summit Creek. During the 1983 flooding that impacted nearly the whole state; Smithfield did experience some rising flow in Summit Creek that were contained by sandbagging.

The Logan Northern Canal flows through much of Smithfield City. Although minimal property damage has occurred, the canal has some sections that have been problematic and vulnerable to bank overflow. Most of the problems are associated with debris accumulation and/or storm surge water levels. Problem areas include areas around 4th South and about 4th East, 1st South to Center Street and 50th East, 3rd to 4th North and 50th West. During the 1983 floods, a large debris flow almost reached the Logan, Hyde Park and Smithfield Canal. Had the canal be blocked significant flooding would have occurred.

The Cache County Storm Water Analysis Report concluded that the Logan, Hyde Park & Smithfield Canal as it passes though Smithfield City is deficient in capacity to accommodate a 10 year storm event of 3 hour duration. The report modeled such a storm event and analyzed drainage capacity of the canal. Potential problem areas were identified where the canal intersects 600 South, 400 South, 200 South, and 200 North in Smithfield (overtopping near 200 North would cause minor damage because it would flow onto the Smithfield Golf Course). Further the Logan Northern Canal was found deficient as it intersects 300 South, 200 East and Center Street in Smithfield City (JUB Engineering, 2003).

Lower portions of **Richmond City** are located in the 100 year flood plain. The flood threat comes from City Creek, a small tributary that drains a portion of the rather steep mountains to the east of Richmond City. Even though a large portion of the city is identified as in the 100 year flood plain, historically no significant flooding has occurred on City Creek. A large portion of the stream flow can be diverted into an irrigation canal above Richmond City. This may act to moderate the impacts of high stream flows.

Assessing Vulnerability: Identifying Assets & Estimating Losses

Table IV-30: Cache County Flooding Residential and Commercial

Jurisdiction Name	Population	Residential Development at Risk		Commercial Development at Risk	
		Units	Value	Units	Income*/Structures**
Amalga Town	Incomplete data-No flood plain map				
Clarkston Town	23	9	$836,787		
Cornish Town	Incomplete data-No flood plain map				
Hyde Park City	31	7	$1,044,463		
Logan City	160	54	$8,091,198	10	$47,800/$5,057

Table IV-30: Cache County Flooding Residential and Commercial					
Jurisdiction Name	**Population**	**Residential Development at Risk**		**Commercial Development at Risk**	
		Units	**Value**	**Units**	**Income*/Structures****
Mendon City	75	22	$3,831,634	1	$1,900/$505
North Logan City	23	8	$1,151,007		
Providence City	7	4	$473,631		
Richmond City	104	34	$4,077,484		
River Heights City	Incomplete data-No flood plain map				
Smithfield City	590	150	$22,060,742	13	$10,300/$6,574
Trenton Town	Incomplete data-No flood plain map				
Wellsville City	100	30	$4,076,888	3	$2,300/$1,517
Unincorporated	913	277	$38,662,627	11	$5,900/$5,563

Population and Residential Development estimates are derived using 2000 Census data
*****2002 estimated total sales revenue (Census)
** Based on average 2002 assessed commercial building value for Cache County
(2002 State Tax Commission Report & Cache County Assessor's Office)
Note: Communities not listed have no residential or commercial property identified in the hazard.
No data was available to analyze the extent and magnitude of potential canal flooding

Table IV-31: Cache County Flooding Other Facilities at Risk				
Jurisdiction Name	**Critical Facilities**	**Roads**	**Power lines**	**Rail Lines**
Amalga Town		.1 miles\$310,000		
Clarkston Town		.2miles\$620,000		
Hyde Park City		.3miles\$930,000		
Lewiston City		.8miles\$2,480,000		.05miles/$12,056
Logan City		1.5miles\$4,650,000		.19miles/$45,815
Mendon City		1.1miles\$3,410,000		
Millville City		.1miles\$310,000		
North Logan City		.5miles\$1,550,000		
Richmond City		.9miles\$2,790,000		.05miles/$12,056
River Heights City				
Smithfield City		3.6miles\$11,160,000		.13miles/$31,347
Wellsville City	Willow Valley Middle	2.1miles\$6,510,000		.09miles/$21,702
Unincorporated		26 miles two lane roads/$82,150,000 .3 miles 4 lane highway/$1,650,000		.93miles/$224,255

See Appendix D for data sources and cost factors.
Note: Jurisdictions not listed have no identified facilities at risk.

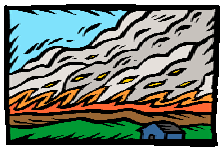
Assessing Vulnerability: Analyzing Development Trends

Many of the municipalities in Cache County do not have adequate ordinances or regulations in place to restrict development in flood prone areas. Development pressure in flood prone areas intensifies as more development occurs and new development is pushed to marginal areas. This is especially true with the cities in the Logan Urbanized Area.

Development is occurring near the numerous irrigation canals. This is to be expected. Canals cut though most communities and are difficult if not impossible to avoid. This is not necessarily a problem. Properly designed and utilized canals are not a flood risk necessarily. The problem is they were designed to transport irrigation water; not storm water. As development occurs in the sub basins near canals, the dramatically increased runoff generated by the added impervious surface area has to go somewhere. A great deal of this urban runoff ends up in the canals.

Existing storm water management systems in many cities rely on these canals to accommodate storm water flows. Many of these canal systems are at capacity for storms of near normal precipitation. Higher than normal storms will put demands on the canal systems that they cannot accommodate. Some problems have already occurred and many more are likely to happen if jurisdictions do not get a handle on alternative methods of storm water management. The most reasonable approach is to require all new development to accommodate its own storm water on-site.

In many circumstances the communities that are at risk from overtopping canals are not necessarily the ones creating the problem. Often canals will flow through one or more communities. It's generally the one farthest downstream that sees the problem. The upstream communities may be the ones generating the most stormwater outflows into the canal but it's the ones at the end of the system that is more likely to get flooded. The solution must include regional cooperation.



CACHE COUNTY WILDFIRES

Background

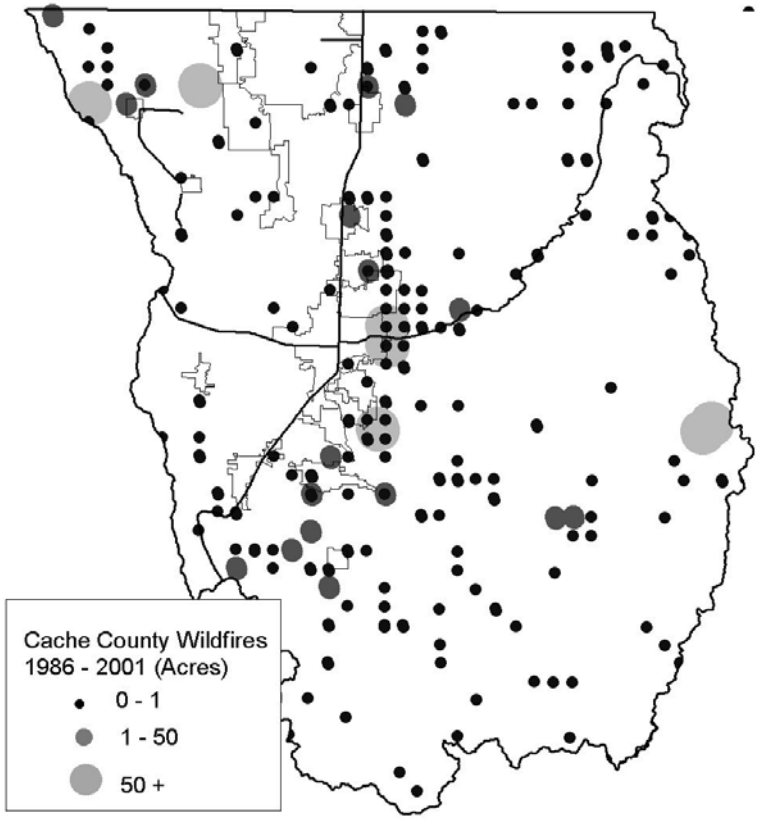
Wildfire has always had an impact on Cache County inhabitants. A few years ago many Logan City residents watched as wildfire crept down the hillside east of the city. Luckily little property damage resulted. To a certain extent, living with wildfires will always be a part living in Cache County.

Many of the communities in Cache County are located along the base of the Bear River Mountains in Cache Valley. Paradise, Millville, Providence, River Heights Logan, North Logan, Hyde Park City and Richmond all have urban interface or potential urban interface with wildfire high risk areas. Wellsville and Mendon on the east side of the valley have potential wildfire-urban conflict for development along the base of the Wellsville Mountains. **See the "Wildfire Hazard" Map in the county annex map section.**

In addition a number of cabins are located on private in-holdings or long term leases in the Cache National Forest.

History of Wildfires in Cache County

The following graphic illustrates the number and rough locations of wild fires in Cache County in the 15 year period from 1986 to 2001.



Cache County Wildfire Hazard Assessment
Hazard Profile

Frequency	Annually (to some extent)
Severity	Severe
Location	Mostly along the Bear River Mountains east of Cache Valley or the Wellsville Mountains west of Cache Valley.
Seasonal Pattern	Generally the worst from early July to mid September (depends on drought conditions)
Duration	A few hours to two weeks
Speed of Onset	1-12 hours
Probability of Future Occurrences	High (Based on data from 1986-2001, there is a 24% chance a fire of at least 1000 acres will occur every year)

Logan City is the most urbanized community in the district. Largely "built-out", a significant amount of recent development has occurred on the eastern side of the city. Much of this development is characterized as upscale and many homes are located on the urban-wild land interface. Electrical power lines for Logan City located on the eastern margin can start wild land fires due to electrical shorts.

In **Unincorporated Cache County**, the Scare Canyon and Hardware Park developments in South East Cache County have about 120 cabins and a large number of developable lots. About 38 cabins are located in Logan Canyon along U.S. 89 many in the Birch Glen area.

Assessing Vulnerability: Identifying Assets & Estimating Losses

Table IV-32: Cache County Wildfire Risk Residential and Commercial

Jurisdiction Name	Population	Residential Development at Risk		Commercial Development at Risk (x 1000)	
		Units	Value	Units	Income*/Structures**
Logan City	172	50	$9,582,954	3	$2,500/$1,517
Millville City	217	53	$7,823,708	10	$7,000/$5,057
Providence City	15	5	$111,586		
Unincorporated	340 329	95 103 cabins	$13,871,710 $12,360,000		

Population and Residential Development estimates are derived using 2000 Census data
*****2002 estimated total sales revenue (Census)
** Based on average 2002 assessed commercial building value for Cache County
(2002 State Tax Commission Report & Cache County Assessor's Office)
Note: Communities not listed have no residential or commercial property identified in the hazard.

Table IV-33: Cache County Wildfires Other Facilities at Risk

Jurisdiction Name	Critical Facilities	Roads	Power lines	Rail Lines
North Logan City			0.4miles/$19,177	
Unincorporated			1.9miles/$91,75	.93miles/$224,256

See Appendix D for data sources and cost factors.
Note: Jurisdictions not listed have no identified facilities at risk.

Assessing Vulnerability: Analyzing Development Trends

The areas that expose development to the most risk from wildfires are often the most desirable places to live. These places afford residents good views, access to public lands, open space and a connection with nature. Most jurisdictions have found it difficult to restrict, limit or modify development proposals for these areas.

The population of Cache County by 2050 is projected to nearly double. For communities to accommodate roughly 100,000 new residents, development pressures will certainly increase in fire prone areas. Increased encroachment on the wild land margins of communities will undoubtedly occur. It has already occurred in Logan City. North Logan and to some extent Hyde Park are beginning to trend this way as well.

CACHE COUNTY LANDSLIDES

Background

Landslide occurrences are common for portions of Cache County. The most frequent problems are associated with debris flows on alluvial fans in many of the canyon drainages. **See the "Landslide Potential" Map in the county annex map section.**

History of Landslides in Cache County

Table IV-34: Cache County Landslide Areas	
Active Landslides (in Acres)	Historically Active Landslides 1847 to present (in Acres)
160	97,731

During the wet years of 1982 & 1983 an abnormally high numbers of landslides occurred in Cache County. A rather large land mass slid into the Porcupine Reservoir upstream of the right abutment. A slide near Nibley Road east of Hyrum occurred in the back yard of a residential home. A slide on College Hill below Utah State University blocked the Logan and Northern Irrigation Canal causing some limited flooding. The road up Millville Canyon was displaced 4 feet by a slide. A debris flow from Dry Creek above Smithfield reached the Logan, Hyde Park and Smithfield Canal (south of 300 South).

Cache County Landslide Hazard Assessment
Hazard Profile

Frequency	Periodic
Severity	Moderate
Location	Generally located in areas with steeper slopes. Debris flows mostly occur at the mouth of canyon drainages.
Seasonal Pattern	Generally the worst in the wetter spring months.
Duration	Up to two weeks
Speed of Onset	No warning
Probability of Future Occurrences	High

Debris flows present a significant threat for development located in the mouths of the many steep canyons located in Cache County. The dynamics of this threat changes depending on the upslope drainage conditions. Wildfire that removes sediment stabilizing vegetation can dramatically increase the risk of debris flows. The other indirect threat comes from canal flooding caused by debris flow blockage.

Accurate spatial data is lacking that defines the extent of the debris flow threat in canyon areas. However areas of concern include the historic alluvial fans of Logan Canyon, Logan Dry Canyon (has been mitigated by a recently constructed debris basin), Green Canyon, Millville Canyon, Providence Canyon, Blacksmith Fork Canyon, Smithfield and Cherry Creek Canyons.

Some portions of the lower "Island" area in Logan are located near active landslide areas. Landslides on these Lake Bonneville sediments are fairly common.

Assessing Vulnerability: Identifying Assets & Estimating Losses

Table IV-35: Cache County Landslide Risk Residential and Commercial (Active Landslides Only)

Jurisdiction Name	Population	Residential Development at Risk		Commercial Development at Risk (x 1000)	
		Units	Value	Units	Income*/Structures**
Logan City	100	33	$5,464,538		
Unincorporated	3	1	$75,693		

Population and Residential Development estimates are derived using 2000 Census data
*****2002 estimated total sales revenue (Census)
** Based on average 2002 assessed commercial building value for Cache County
(2002 State Tax Commission Report & Cache County Assessor's Office)
Note: Communities not listed have no residential or commercial property identified in the hazard.
Data does not include areas susceptible to debris flows (no data available)

Table IV-36: Cache County Landslides Other Facilities at Risk (Active Landslides Only)

Jurisdiction Name	Critical Facilities	Roads	Power lines	Rail Lines
Logan City		.3 miles/$930,000		

See Appendix D for data sources and cost factors.
Note: Jurisdictions not listed have no identified facilities at risk.

Table IV-37: Cache County Landslide Risk Residential and Commercial (Active & Historically Active Landslides)

Jurisdiction Name	Population	Residential Development at Risk		Commercial Development at Risk (x 1000)	
		Units	Value	Units	Income*/Structures**
Hyrum City	47	10	$1,223,044		
Logan City	3,775	1,207	$125,675,961	9	$47,300/$4,551
Providence City	50	15	$3,174,217		
Unincorporated	286	75	$13,806,238	24	$20,200/$12,137

Population and Residential Development estimates are derived using 2000 Census data
*****2002 estimated total sales revenue (Census)
** Based on average 2002 assessed commercial building value for Cache County
(2002 State Tax Commission Report & Cache County Assessor's Office)
Note: Communities not listed have no residential or commercial property identified in the hazard.
Data does not include areas susceptible to debris flows (no data available)

Table IV-38: Cache County Landslides Other Facilities at Risk (Active & Historically Active Landslides)				
Jurisdiction Name	**Critical Facilities**	**Roads**	**Power lines**	**Rail Lines**
Hyrum City		1.2miles/$3,720,000		
Logan City		16.9miles/$52,390,000		
Millville City		0.1miles/$310,000		
North Logan City			0.1miles/$4,793	
Providence City		0.7miles/$2,170,000		
Trenton Town		0.2miles/$620,000		
Unincorporated		7.1miles/$2,201,000	0.1miles 345Kv line/$4,821 1.7miles 138Kv line/$81,488	.92miles./$221,844
See Appendix D for data sources and cost factors. **Note: Jurisdictions not listed have no identified facilities at risk.** Data does not include areas susceptible to debris flows (no data available)				

Assessing Vulnerability: Analyzing Development Trends

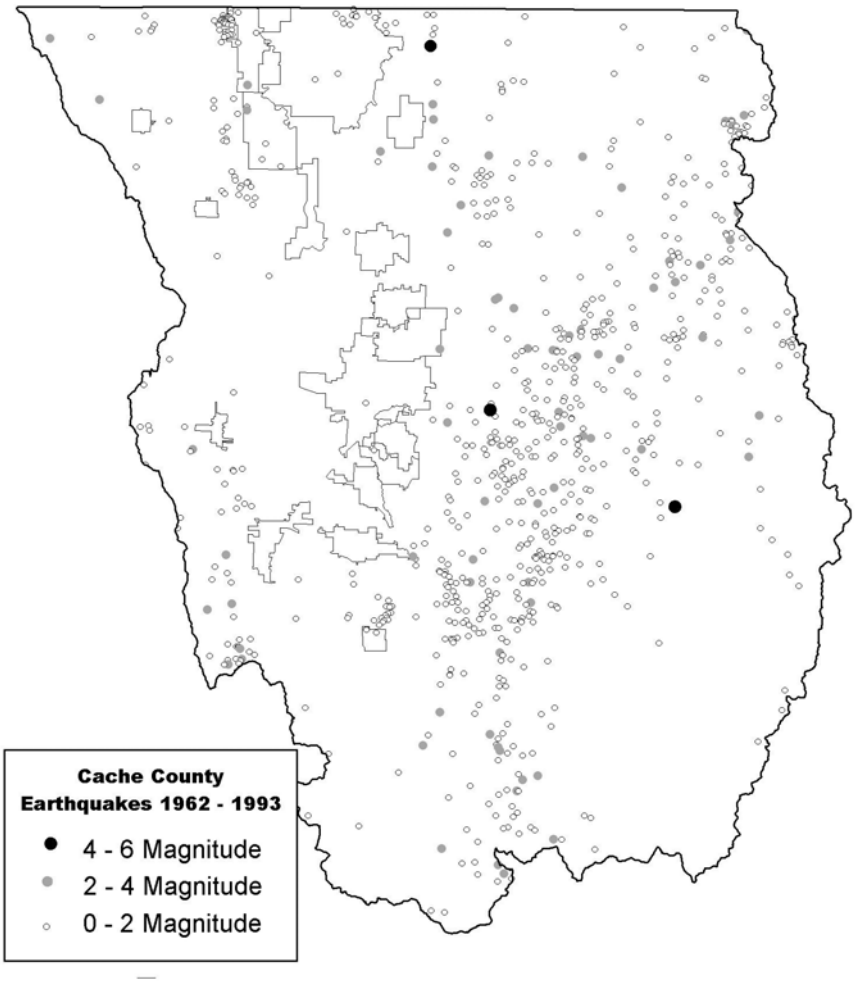
Increasing development occurring in the mouths of canyons along the Bear River Range should be of critical concern to local land use officials. Logan Canyon and Dry Canyon already have significant development. Increasing development pressure will be on Green Canyon above rapidly growing North Logan and to a lesser extent Providence and Millville Canyons.

CACHE COUNTY EARTHQUAKES

Background

Cache County is located in a seismically active region within the Intermountain Seismic Belt. The most damaging earthquake in Utah's post European settlement history occurred in near Richmond City in Cache County. In 1962 a M_L 5.7 earthquake occurred near Richmond that damaged nearly three-fourths of the homes in the town. Damage to homes and building occurred in many surrounding areas of Cache Valley (Christenson, 1992). Some geologic evidence suggest that an earthquake of magnitude seven plus has occurred in the recent geologic past on the west cache fault zone. **See the "Earthquake Fault Zone" and "Liquefaction Potential" Map in the county annex map section.**

History of Earthquakes in Cache County



Cache County Earthquake Hazard Assessment
Hazard Profile

Frequency	Low magnitude events occur frequently. Larger magnitude events are rare (although not necessarily on geologic scale).
Severity	Potentially Catastrophic
Location	Entire County with highest frequency in the Bear River Mountain Range. Surface fault ruptures are likely to occur in fault zones and liquefaction would impact large portions of the county.
Seasonal Pattern	None
Duration	A few minutes with potential aftershocks
Speed of Onset	No warning
Probability of Future Occurrences	Based on 1962-1993 data, there is a 29% chance every year of an earthquake of 3.0 magnitude or greater.

Three important fault zones have influence on Cache County. The East Cache Fault bounding the eastern portion of Cache Valley, the West Cache Fault bounding the western valley and the nearby Wasatch Fault. The majority of Cache County's population is located near the Eastern Cache Fault. Evidence points to the Temple Fork Fault as the most active in Cache County. Although miles away from the epicenter, this fault it thought to be associated with the 1962 Richmond Earthquake.

Areas in **Nibley**, western **Millville** and **Providence** and **River Heights** and southern **Logan City** have been identified with high liquefaction potential (see Cache County Liquefaction Map). In addition, much of the Bear River meander corridor has high liquefaction potential in the event of a Cache Valley earthquake (mostly un-developable river-bottom land).

Exposed risk to fault surface rupture exists in parts of upper Logan City, Millville, North Logan and Smithfield (See Cache County Fault Map).

Assessing Vulnerability: Identifying Assets & Estimating Losses

Table IV-39: Cache County Earthquake Risk (Liquefaction) Residential and Commercial

Jurisdiction Name	Population	Residential Development at Risk		Commercial Development at Risk (x 1000)	
		Units	Value	Units	Income*/Structures**
Amalga Town	71	19	$2,404,998		
Logan City	6,905	2,553	$254,471,823	162	$765,500/$81,929
Nibley City	995	295	$42,194,645	6	$8,600/$3,034
Providence City	81	19	$1,997,362	9	$9,400/$4,551
River Heights City	59	26	$3,873,180	17	$21,300/$8,597
Trenton Town	5	3	$270,264		
Wellsville City	199	69	$9,682,994		
Unincorporated	936	333	$26,161,146	18	$221,600/$9,103

Population and Residential Development estimates are derived using 2000 Census data
*****2002 estimated total sales revenue (Census)

Table IV-39: Cache County Earthquake Risk (Liquefaction) Residential and Commercial					
Jurisdiction Name	**Population**	**Residential Development at Risk**		**Commercial Development at Risk (x 1000)**	
		Units	**Value**	**Units**	**Income*/Structures****
** Based on average 2002 assessed commercial building value for Cache County (2002 State Tax Commission Report & Cache County Assessor's Office) **Note: Communities not listed have no residential or commercial property identified in the hazard.**					

Table IV-40: Cache County Earthquakes (Liquefaction) Other Facilities at Risk				
Jurisdiction Name	**Critical Facilities**	**Roads**	**Power lines**	**Rail Lines**
Amalga Town		3.3miles/$10,230,000	.198miles/$9,491	
Cornish Town		0.8miles/$2,480,000		.31miles/$74,752
Lewiston City		2.4miles/$7,440,000		1.87miles/$540,922
Logan City	Logan So. Campus, Riverside & Wilson School,	1.7miles of highway/$9,350,000 2708miles of 2 lane road/$86,180,000		
Millville City		1.9miles/$5,890,000		.68miles/$163,972
Nibley City	Nibley School	6.5miles/$20,150,000		.88miles/$212,199
Providence City		1.5miles/$4,340,000		
Trenton Town		1.1miles/$3,410,000		
Wellsville City		4.7miles/&14,570,000		.48miles/$115,745
Unincorporated		1.6miles of highway/$8,800,000 30.8 miles of 2 lane road/$95,480,000	.98miles/$46,975	1.22miles/$294,185
See Appendix D for data sources and cost factors. **Note: Jurisdictions not listed have no identified facilities at risk.**				

Table IV-41: Cache County Earthquake Risk (Fault Zone) Residential and Commercial					
Jurisdiction Name	**Population**	**Residential Development at Risk**		**Commercial Development at Risk (x 1000)**	
		Units	**Value**	**Units**	**Income*/Structures****
Logan City	43	18	$3,046,896		
North Logan City	27	6	$1,277,345		
Smithfield City	68	18	$2,634,398		
Trenton Town	9	3	$358,414		
Unincorporated	554	15	$2,578,287		
Population and Residential Development estimates are derived using 2000 Census data *****2002 estimated total sales revenue (Census) ** Based on average 2002 assessed commercial building value for Cache County (2002 State Tax Commission Report & Cache County Assessor's Office) **Note: Communities not listed have no residential or commercial property identified in the hazard.**					

Table IV-42: Cache County Earthquakes (Fault Zone) Other Facilities at Risk				
Jurisdiction Name	**Critical Facilities**	**Roads**	**Power lines**	**Rail Lines**
North Logan City			0.1miles/$4,793	
Trenton Town				.17miles/$40,993
Unincorporated			0.1miles 345Kv line/$4,821 1.7miles 138Kv line/$81,488	.31miles/$74,752
See Appendix D for data sources and cost factors. **Note: Jurisdictions not listed have no identified facilities at risk.**				

Note: A 2001 study titled "Seismic-Hazard Mapping of the Central Cache Valley, Utah-A Digital Pilot Project" by McCalpin and Solomon provide next generation analysis and mapping of earthquake hazard mapping for the Newton, Smithfield, Wellsville and Logan 7.5-minute USGS quadrangles. The information contained in this report is certainly considered more accurate and the delineations more defensible; however for consistency this information was not used in the hazard analysis of this plan.

Cache County HAZUS Analysis

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates can be used by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The results of the model ran for Cache County simulates a 2,500 year event with a earthquake magnitude of 7.0.

Table IV-43: Cache County Human Casualty Estimates (HAZUS Model 7.0 Magnitude Earthquake)					
Timing	Sector	Level 1	Level 2	Level 3	Level 4
2 A.M	Commercial	6	2	0	1
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	4	1	0	0
	Industrial	10	3	0	1
	Residential	199	50	6	12
	Single Family	386	96	13	25
	Total	605	152	20	39
2 P.M.	Commercial	372	111	18	36
	Commuting	0	0	0	0
	Educational	206	61	10	20
	Hotels	1	0	0	0

Table IV-43: Cache County Human Casualty Estimates (HAZUS Model 7.0 Magnitude Earthquake)					
Timing	Sector	Level 1	Level 2	Level 3	Level 4
	Industrial	74	22	4	7
	Residential	11	2	0	0
	Single Family	59	15	2	4
	Total	723	212	35	68
5 P.M.	Commercial	337	100	17	32
	Commuting	0	0	0	0
	Educational	58	17	3	6
	Hotels	1	0	0	0
	Industrial	46	14	2	4
	Residential	76	19	2	5
	Single Family	152	38	5	10
	Total	670	188	30	57

Severity Level 1: Injuries will require medical attention buy hospitalization is not needed.
Severity Level 2: Injuries will require hospitalization buy are not considered life-threatening.
Severity Level 3: Injuries will require hospitalization and can become life threatening in not promptly treated.
Severity Level 4: Victims are killed by the earthquake.

Table IV-44: Cache County Building-Related Economic Loss Estimates in $ Millions (HAZUS Model 7.0 Magnitude Earthquake)							
Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Loses	Wage	0	1.46	25.12	1.24	1.42	29.24
	Capital-Related	0	.62	22.29	.75	.55	24.21
	Rental	16.79	17.43	12.73	.69	.69	48.32
	Relocation	1.55	.38	.58	.05	.20	2.76
	Subtotal	18.33	19.88	60.72	2.72	2.86	104.52
Capital Stock Loses	Structural	83.89	22.53	36.91	8.25	6.19	157.76
	Non-structural	294.13	109.22	98.06	27.94	20.95	550.29
	Content	70.51	22.50	43.39	17.87	10.22	164.50
	Inventory	0	0	1.44	2.57	.17	4.18
	Subtotal	448.52	154.26	179.80	56.64	37.52	876.74
	Total	466.86	174.14	240.52	59.36	40.39	981.26

Table IV-45: Cache County Transportation System Loss Estimates in $ Millions (HAZUS Model 7.0 Magnitude Earthquake)			
System	Component	Inventory Value	Economic Loss
Highway	Segments	1,052	0
	Bridges	27	4
	Subtotal	1079	4
Railways	Segments	79	0
	Bridges	0	0

Table IV-45: Cache County Transportation System Loss Estimates in $ Millions (HAZUS Model 7.0 Magnitude Earthquake)			
System	Component	Inventory Value	Economic Loss
	Subtotal	79	0
Airport	Facilities	5	2
	Runways	91	0
	Subtotal	96	2
	Total		

Table IV-46: Cache County Transportation System Loss Estimates in $ Millions (HAZUS Model 7.0 Magnitude Earthquake)				
Classification	Total	Least Moderate Damage > 50%	Complete Damage > 50%	Functionality >50% at day 1
Hospitals	1	0	0	1
Schools	32	4	0	0
Police Stations	4	0	0	0
Fire Stations	7	0	0	0
On the day of the earthquake the model estimates that only 100% of the hospital beds in the county would be available for patient use.				

Table IV-47: Cache County Expected Building Damage by Occupancy (HAZUS Model 7.0 Magnitude Earthquake)										
	None		Slight		Moderate		Extensive		Complete	
	Count	%	Count	%	Count	%	Count	%	Count	%
Agriculture	0	.01	0	.01	1	.01	0	.01	0	.02
Commercial	24	.69	42	.59	89	1	69	3	40	3
Education	1	.02	1	.01	2	.03	2	.07	1	.05
Government	0	.01	1	.01	1	.02	1	.04	1	.05
Industrial	4	.11	6	.08	14	.18	12	.45	7	.58
Religion	0	.01	1	.01	1	.02	1	.04	0	.04
Residential	279	8	624	9	899	12	602	23	291	25
Single Family	3,127	91	6,441	90	6,664	87	1,898	73	817	70
Total	3,435		7,116		7,672		2,585		1,158	

Assessing Vulnerability: Analyzing Development Trends

Development in Logan and North Logan has already encroached on areas that are susceptible to surface fault rupture on the Cache East Fault. Development pressure will increase for these towns as well as Providence, Millville and Richmond to build higher on the hillside and potentially build on active fault lines.

Some of the southwestern areas of Logan City have seen recent high growth. Much of this area has been identified as having high liquefaction potential in the event of a 5 plus earthquake.

Proposed annexation plans encompassing portions of the unincorporated College-Young Ward area also have identified problems with soils prone to liquefaction.

CACHE COUNTY DAM FAILURE

Background

There are 225 regulated dams located in Cache County. Most of these dams are small detention ponds, small agricultural reservoirs or livestock watering facilities and most pose a minimal threat to human safety or property.

Of the 225 regulated dams 215 are designated as “low hazard” by the State of Utah Division of Water Rights. As defined by state statue, low hazard dams are those dams which, if they fail, would cause minimal threat to human life, and economic losses would be minor or limited to damage sustained by the owner of the structure.

A total of 5 dams have been designated as “moderate hazard” by the State of Utah in Cache County. Moderate Hazard dams which, if they fail, have a low probability of causing loss of human life, but would cause appreciable property damage, including damage to public utilities.

The State of Utah has rated 5 dams in Cache County as “high hazard” which means that, if they fail, have a high probability of causing loss of human life or extensive economic loss, including damage to critical public utilities.

Dam failure inundation maps and emergency action plans for each of the high risk dams can be found on the Utah Division of Water Right’s website at: http://waterrights.utah.gov/cgi-bin/damview.exe?Startup.

History of Dam Failure in Cache County

No significant dam failures have occurred in Cache County.

Cache County Dam Failure Hazard Assessment
Hazard Profile

Frequency	Rare
Severity	Potentially Catastrophic
Location	Areas down stream of failed dam.
Seasonal Pattern	Anytime. Highest risk in spring during snowmelt.
Duration	A few hours
Speed of Onset	No warning
Probability of Future Occurrences	Low

Assessing Vulnerability: Identifying Assets & Estimating Losses

Cutler Dam
Cutler Dam and reservoir lie in extreme western Cache County and about four miles east northeast of Fielding in Box Elder County. This facility has a hazard rating of high. The inundation area follows the Bear River flood plain first southwesterly and then south past Deweyville, Elwood, Honeyville, Bear River City and finally Corrine City before ending at the Great Salt Lake. Since the inundation area remains, for the most part, within the flood plain, threats the population and homes appears to be minimum.

Hyrum Dam
Hyrum Dam and Reservoir are located directly south of Hyrum City on the Little Bear River. The dam is rated as a high hazard facility and the inundation area flows westerly towards Wellsville five miles away, and then into Cutler Marsh.

Logan First Dam
This facility located near the mouth of Logan Canyon has a high hazard rating. The inundation area consists of most of the Island area, much of the landscape around the Logan River Golf Course and County Fairgrounds, and continuing west towards Cutler Reservoir. There is a significant population as well as large numbers of homes and businesses within the inundation area.

Porcupine Dam
Porcupine Dam is located about eight miles upriver from the town of Paradise on the east fork of the Little Bear River. The dam has a high hazard rating. There is no inundation map associated with this dam. This dam was recently drained and some reinforcement work performed.

Newton Dam
Newton dam was constructed by the Bureau of Reclamation on Clarkston Creek three miles north of the town of Newton. This facility has a high hazard rating. There is no inundation map associated with this dam.

Assessing Vulnerability: Analyzing Development Trends

Any new downstream development that is located in the floodplain increases the exposure to risk in terms of human life and property. Given the relatively low probability of catastrophic dam failures, most jurisdictions are unwilling to regulate development in dam failure inundation areas.

CACHE COUNTY HAZARD MITIGATION STRATIGIES

Hazard Mitigation Goals

The following goals were identified to direct the county's hazard mitigation strategies. These general goals were identified and developed based on the local official surveys (See appendix A), input from the Bear River District PDM Technical Planning Team and Steering Committee.

Goal # 1: Minimize potential impacts for future development

- **Develop, refine and improve the hazard data available to local level decision makers.**
- **As appropriate, develop and implement regulatory mechanisms to insure new development activities will not increase the risk to life or property.**
- **Build technical capacity for local elected and appointed officials.**
- **Empower citizens to make informed choices.**

Goal # 2: Minimize potential impacts for existing development

- **Improve emergency disaster response capabilities.**
- **Improve the disaster resistance of existing infrastructure and critical facilities.**
- **Educate and build capacity of citizens to undertake mitigation activities.**

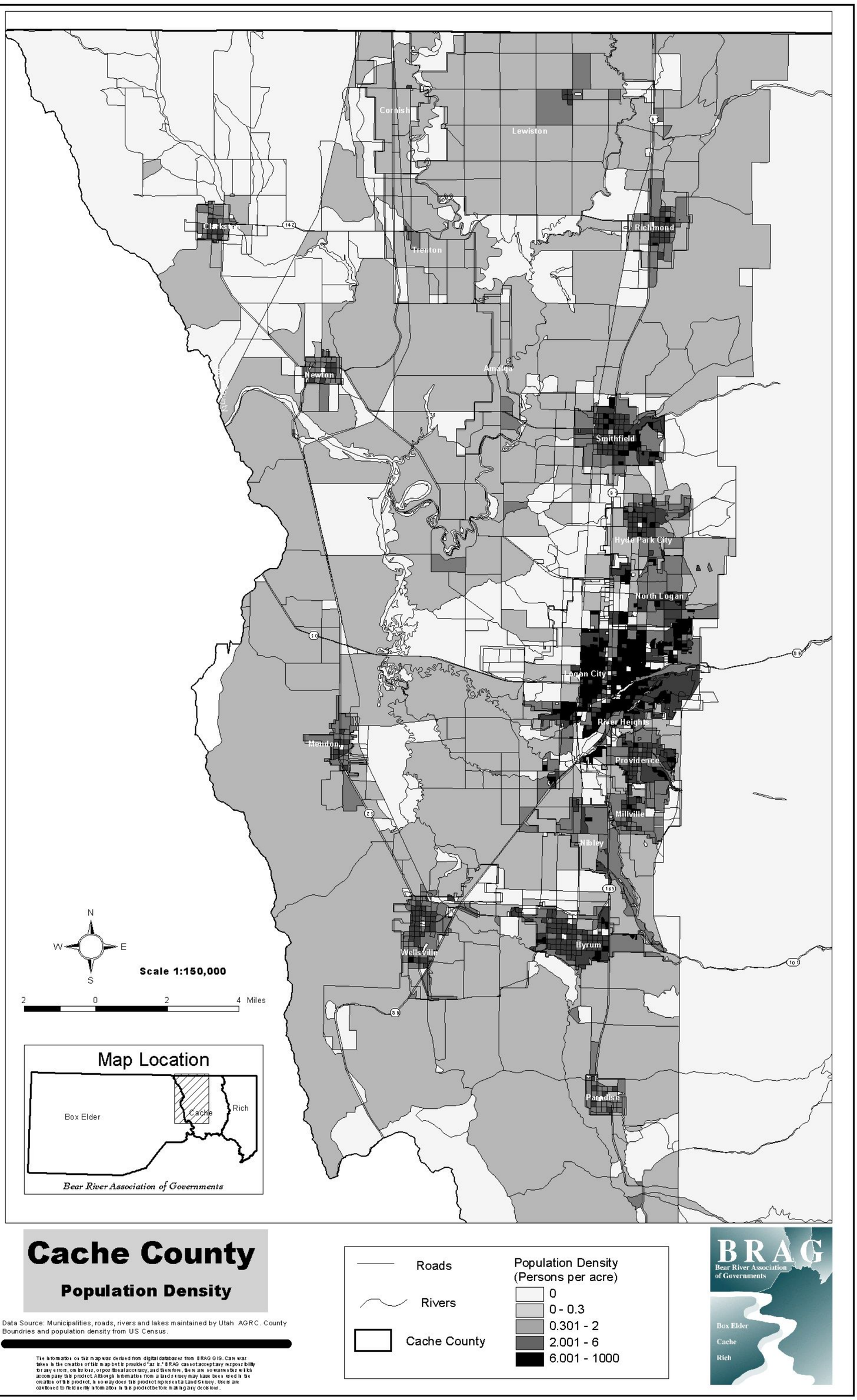
To accomplish these goals specific mitigation strategies were developed by participating jurisdictions. These goals were given assigned a priority of high, medium, or low by Bear River District PDM Technical Planning Team and Steering Committee. Priorities were give taking into account the following factors:

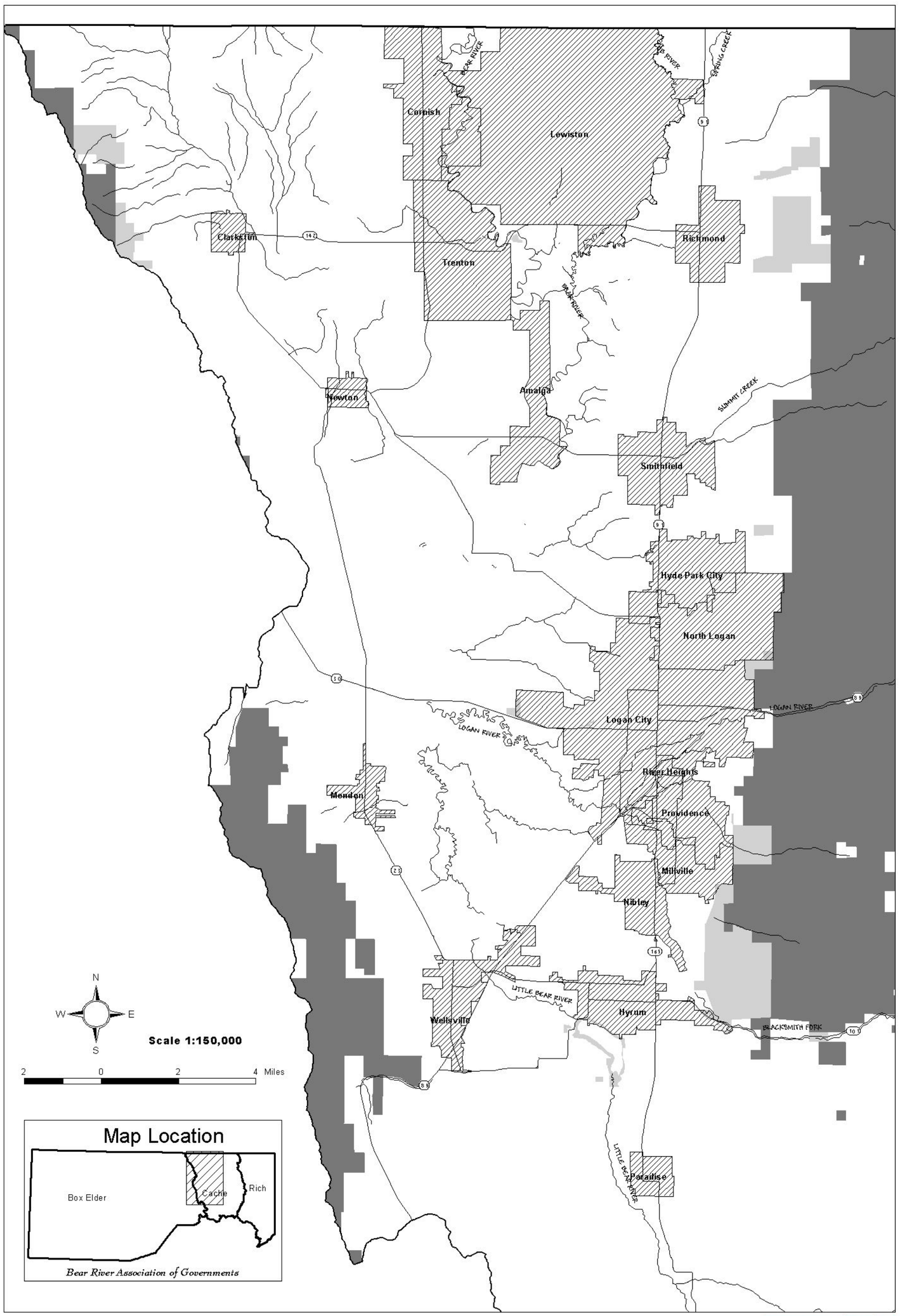
- Number of people protected by the project
- Technical feasibility
- Political support
- Environmental impacts
- Available funding source

A guiding factor in prioritizing mitigation was the though that mitigation should provide the greatest amount of good to the greatest amount of people when cost was taken into account. Prioritizing mitigation was difficult in this plan as each as Bear River is vulnerable to many different hazards. Each with its own characteristics. Thus, recurrence intervals, past events, damage estimates compiled during the assessing vulnerability section of this plan were also taken into account.

CACHE COUNTY NATURAL HAZARD MITIGATION PROJECTS Bear River District Pre-Disaster Mitigation Plan 2004									
Hazard	**Goal**	**Jurisdiction(s)**	**Objective**	**Project Description**	**Priority**	**Timeframe**	**Potential Funding**	**Estimated Cost**	**Resources**
Multi-Hazard	Goal 2	All Jurisdiction	Prepare for Severe Weather Events	Become a National Weather Service "Storm Ready" Community (http://www.stormready.noaa.gov/)	Medium	2006		Minimal	NOAA
Multi-Hazard	Goal 1 & 2	All Jurisdictions	Make critical infrastructure disaster resistant.	Provide for a redundant source of electrical power in Cache Valley.	High	2007	Pacificorp, Local, Logan City, Hyrum City	YTD	Cache Chamber of Commerce, UDESHS
Flooding	Goal 1 & 2	Unincorporated County, Nibley City	Reduce the threat of flooding from the Blacksmith Fork River	Dredge and widen the river channel, and build up river bank at 5200 South on the parallel to Hollow Road.	High	2006	Local, FEMA	$4,500	
Flooding	Goal 1 & 2	Amalga, Nibley, Paradise, Trenton	Mitigate impacts related to flooding.	Initiate participation in the National Flood Insurance Program (NFIP) to enable home owners to purchase flood insurance.	High	2005		Minimal	UDESHS, ACOE
Flooding	Goal 1 & 2	Jurisdictions with identified flood hazards	Make better informed decisions.	Develop a floodplain map for communities that do not have one. Refine, update and improve existing flood plain mapping.	Medium	2009	FEMA, UDESHS, Local	$2,500 to $65,000 each	Consultants, FEMA, UDESHS, Public Works
Flooding	Goal 1 & 2	All Jurisdictions with Canals	Minimize flood risk from canal failure or overtopping	For those that have not already been studied, analyze and model the canals to determine deficiencies related to present and future demands (taking into account projected storm water increases based on projected development).	Medium	2007	Local, FEMA	$95,000	Consultants
Flooding	Goal 1 & 2	All Jurisdictions	Minimize flood risk from storm water runoff.	Work toward requiring all new development to accommodate its own storm water discharge on-site. Develop ordinances and standards that require new development be designed to do on-site storm water retention.	Medium	2005	Local Funds, EPA, FEMA	$7,000 per jurisdiction	BRAG, EPA, Utah Association of Conservation Districts, FEMA, UDESHS
Flooding	Goal 2	Logan City	Improve Logan City's flood management capability.	Dredge 1st, 2nd & 3rd Dams. Mud and silt has built up over the years causing the settlement area to shrink.	Medium	2005	Local Funds, FEMA	Approx $120,000 per dam	
Wildfire	Goal 2	Paradise, Hyrum, Wellsville, Millville, Providence, Logan, North Logan, Hyde Park, Smithfield, Mendon and Richmond	Become "Firewise" communities.	Enact ordinance and planning procedures to insure development in fire prone areas are done wisely. Provisions for multiple access routes, firebreaks, wide roads and adequate water sources should be included. Standards for homes should be enforced that require defensible space and fire wise building materials and designs (see www.firewise.org).	High	2007		Minimal	BRAG, Utah Division of State Lands, Fire and Forestry, Utah League of Cities and Towns.
Earthquake and Landslide	Goal 1 & 2	All Jurisdictions	Make better informed decisions.	Obtain better earthquake information for local level decision makers. This work has been done for the Newton, Wellsville, Logan and Smithfield 7.5 USGS quads. Complete similar work for the Clarkston, Richmond, Trenton and Paradise 7.5 minute quads. .	Medium	2008	Utah Geologic Survey, Local	$45,000	Utah Geologic Survey, BRAG
Earthquake and Landslide	Goal 1	All Jurisdictions	Avoid placing new development at risk from geologic hazards.	Develop land use ordinances that require site specific geo-hazard studies be performed prior to development permitting in areas determined to be high risk related to earthquakes (especially for critical or high-occupancy buildings).	High	2006		Minimal	Utah Geologic Survey, BRAG, Utah League of Cities and Towns.

PART IV-CACHE COUNTY ANNEX HAZARD MAPPING


Cornish
Lewiston
Clarkston
Trenton
Richmond
Newton
Amalga
Smithfield
Hyde Park City
North Logan
Logan City
River Heights
Mendon
Providence
Millville
Nibley
Wellsville
Byrum
Paradise
N
W
E
S
Scale 1:150,000
2 0 2 4 Miles
Map Location
Box Elder
Cache
Rich
Bear River Association of Governments
Cache County
Population Density
Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County Boundries and population density from US Census.
The information on this map was derived from digital databases from BRAG GIS. Care was taken in the creation of this map but is provided "as is." BRAG cannot accept any responsibility for any errors, omissions, or positional accuracy, and therefore, there are no warranties which accompany this product. Although information from aerial surveys may have been used in the creation of this product, in no way does this product represent a Land Survey. Users are cautioned to field verify information in this product before making any decisions.
Roads
Rivers
Cache County
Population Density
(Persons per acre)
0
0 - 0.3
0.301 - 2
2.001 - 6
6.001 - 1000
BRAG
Bear River Association of Governments
Box Elder
Cache
Rich



Cache County
Land Ownership

Roads
Rivers
Cache County
Municipalities

Land Ownership
Private
State Lands
Federal Lands
Sovereign Lands

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich

Data Source: Municipalities, ownership, roads, rivers and lakes maintained by Utah AGRC. County Boundries from U.S. Bureau of the Census.

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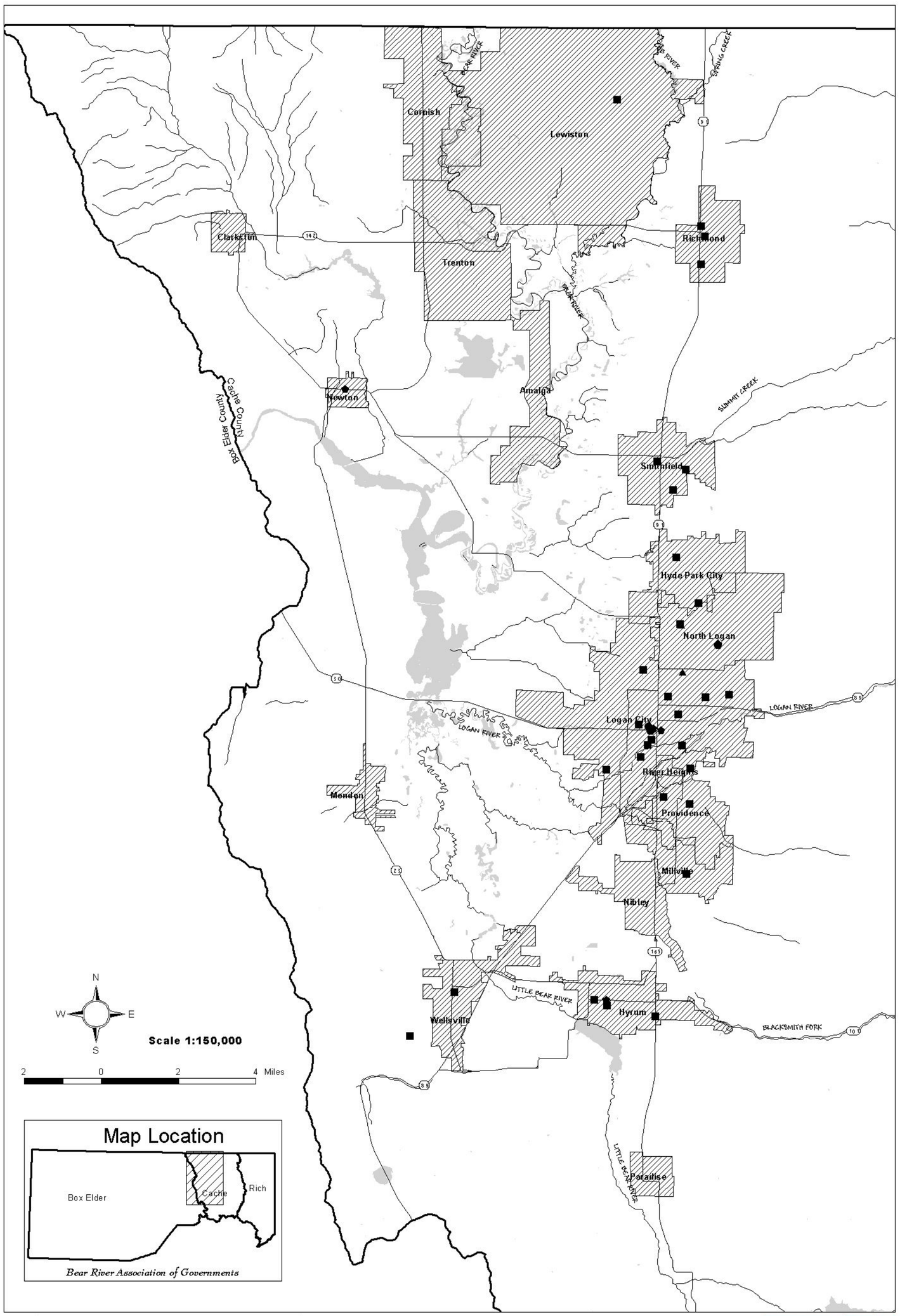


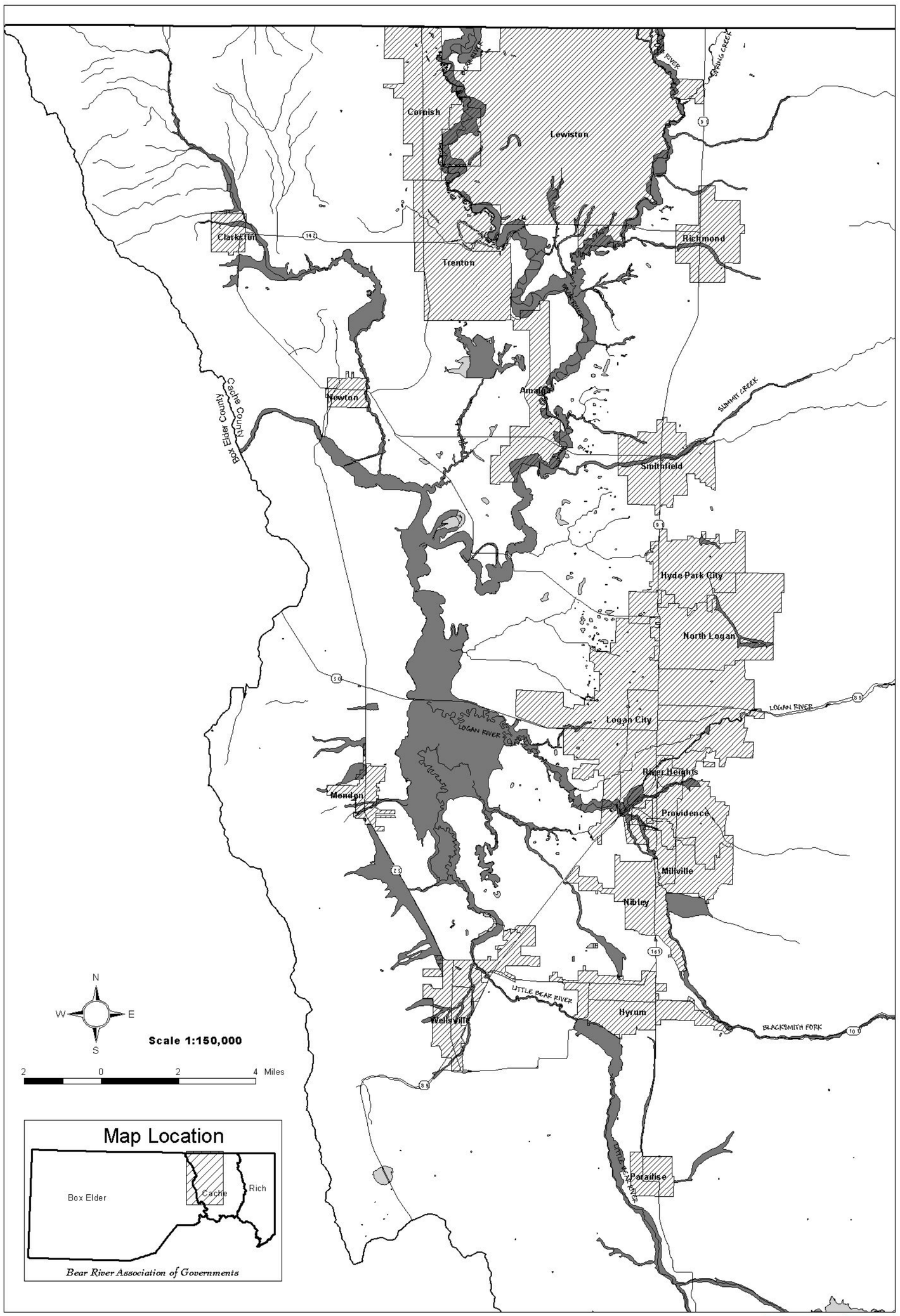
Cache County

Critical Facilities

Roads
Rivers
Lakes
Municipalities
Police Station
School
Hospital
Fire Station
Cache County

Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County Boundries from US Census.

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich



Cache County

FEMA Flood Zone

Roads
Rivers
Lakes
FEMA Flood Zone
Municipalities
Cache County

Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County Boundries from US Census. FEMA flood zone digitized from paper FIRM maps.

The information on this map was derived from digital databases from BRAG GIS. Care was taken in the creation of this map but is provided "as is." BRAG cannot accept any responsibility for any errors, omissions, or positional accuracy, and therefore, there are no warranties which accompany this product. Although information from aerial surveys may have been used in the creation of this product, in no way does this product represent a Land Survey. Users are cautioned to field verify information in this product before making any decisions.

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich

Cache County

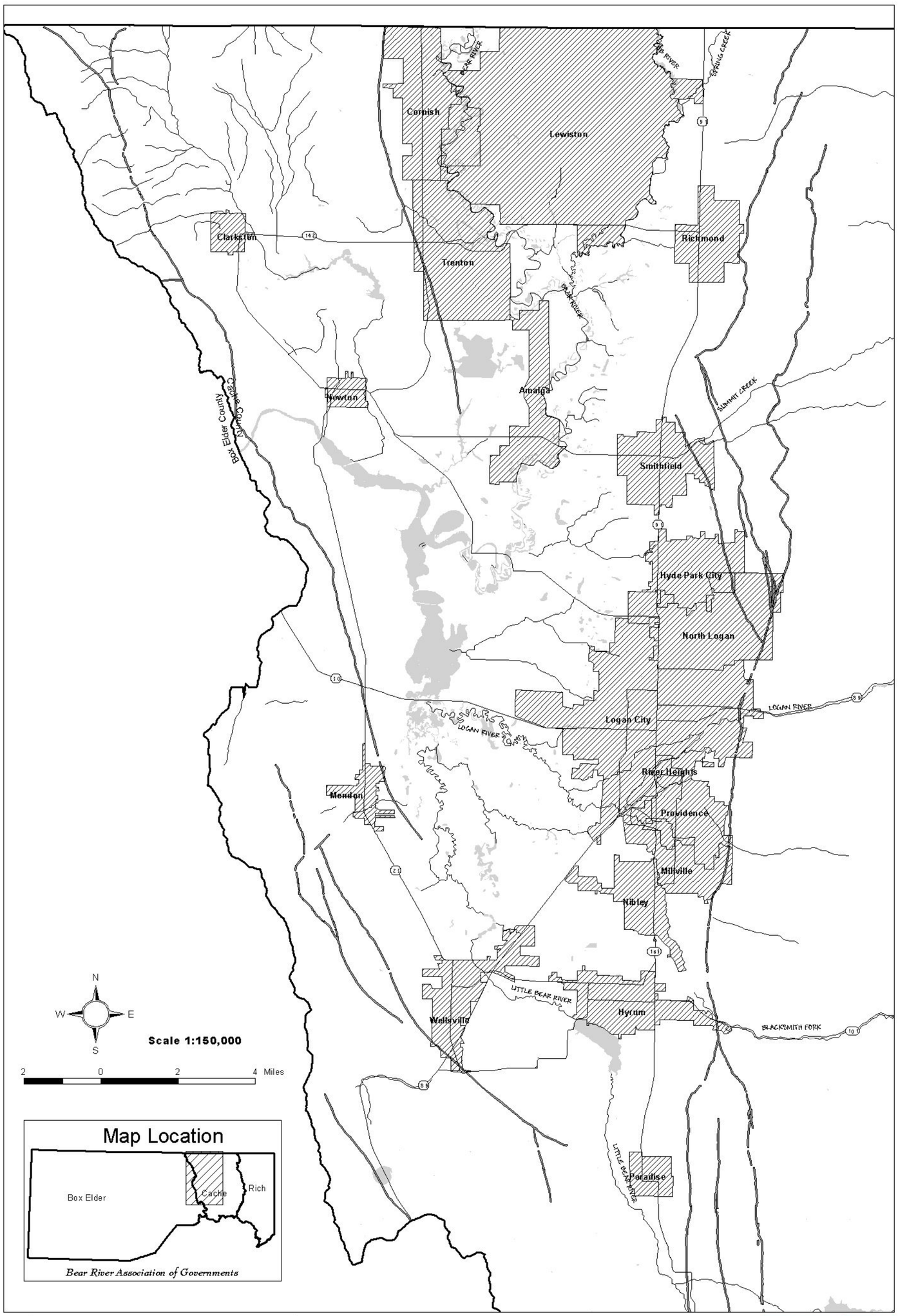
Wildfire Hazard

Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County Boundries from US Census. Fire classes from BLM Fire Hazard Analysis.

Roads
Rivers
Lakes
Municipalities
Moderate Fire Hazard
High and Extreme Fire Hazard
Cache County

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich

Landslide Missing

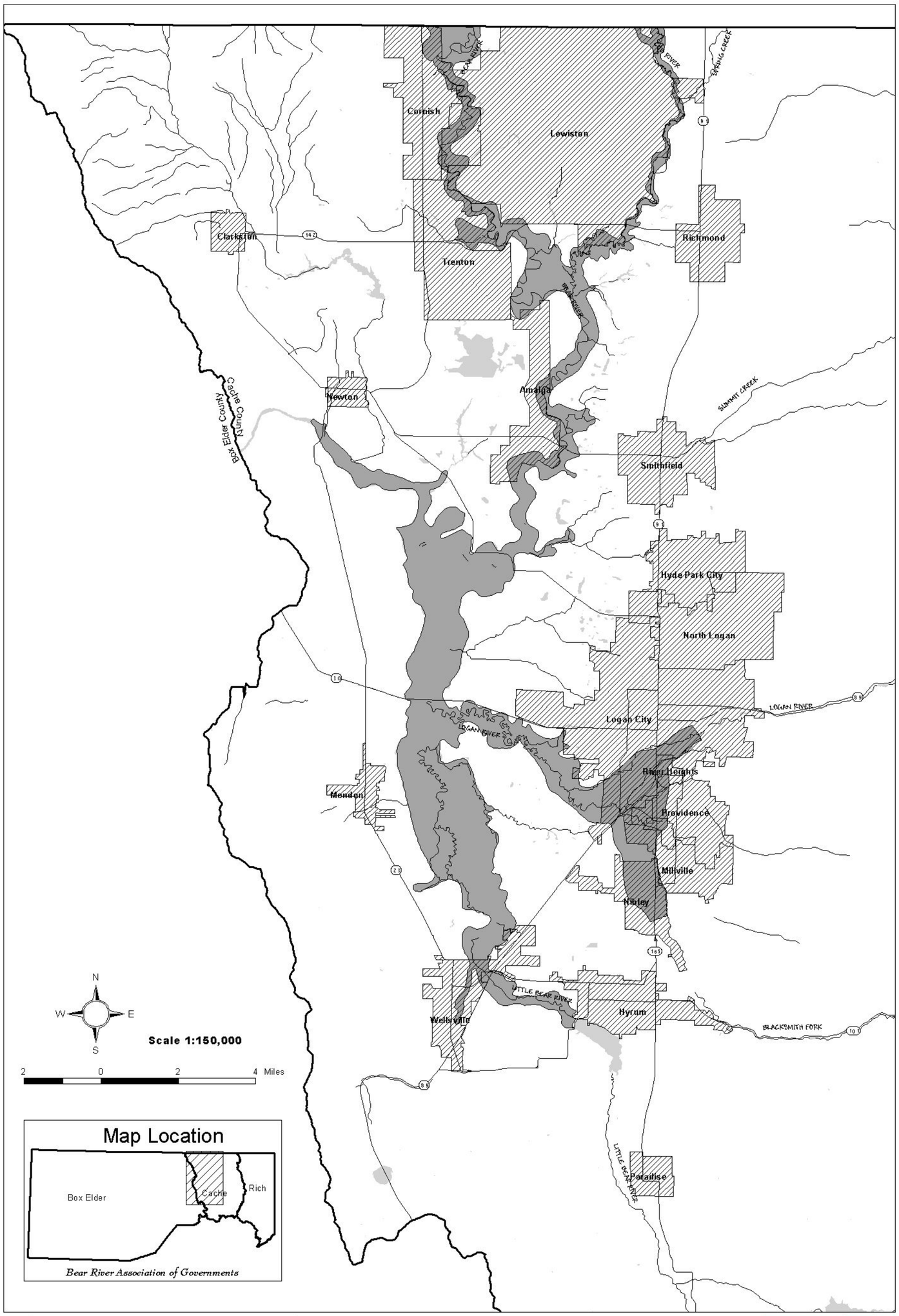


Cache County
Earthquake Fault Zone

Roads
Rivers
Lakes
100' Fault Zone
Municipalities
Cache County

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich

Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County Boundries from US Census. Fault zones derived from "Quaternary Tectonics of Utah" (Hecker, Utah Geological Survey Bulletin 127, 1993)



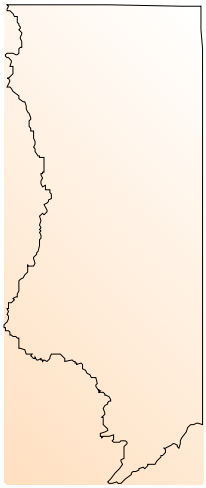
Cache County
Liquifaction Potential

Roads
Rivers
Lakes
High Liquifaction
Municipalities
Cache County

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich

Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County Boundries from US Census.

PART IV-RICH COUNTY ANNEX RISK ASSESSMENT



GENERAL BACKGROUND INFORMATION

Rich County, located in the northeast corner of Utah occupies a land area of 1,034 square miles, extending from Wyoming on the east and Idaho on the north, with the southern portion of the Bear Lake extending into the County.

In 1863, members of the Church of Jesus Christ of Latter-day Saints (Mormons), under the leadership of Apostle Charles C. Rich, settled the northern portion of Bear Lake Valley in what is now Bear Lake County, Idaho. A year later, settlers began establishing themselves in the southern part of the valley in the vicinity of present day Meadowville, Utah (an unincorporated area), and at several other locations in Round Valley. The move into the southern Bear Lake Valley brought the settlers into conflict with Chief Washakie and his band of Shoshoni, who had historically used the area as an annual gathering place. Ongoing conflicts with these Native Americans continued until 1872 at which time Washakie and his people relocated to the Wind River reservation in Wyoming. Mormon settlers then freely expanded their settlements from Bear Lake Valley into neighboring Bear River Valley, establishing the site of Randolph in 1870, and Woodruff in 1871. In 1872 the federal government completed its survey of the area and established the exact location of the forty-second parallel, separating Idaho and Utah. After 1872 the Rich County seat was moved from Paris, (Idaho) to Randolph, Utah.

Rich County is comprised of two separate geographical regions: Bear Lake Valley and Bear River Valley. Nearly forty miles separate the communities of Woodruff and Garden City. The geographic isolation of the two valleys and the difficulty of travel between communities in each, resulted in the somewhat separate development of each. Randolph and Woodruff developed more similarities with the Wyoming communities within Bear River Valley than they did with the Bear Lake communities of Garden City and Laketown. Laketown and Garden City, had more in common with the Idaho communities of the Bear Lake Valley.

Most of Rich County is highland, but is well known for its lowlands which support productive farms and livestock. Of its 659,840 square miles, less than one acre in ten is devoted to crop production. Grazing on the other hand occupies one half of the County's acreage. Livestock and livestock products account for eighty percent of the County's income. There are also about 243 farms in Rich County which average 2,162 acres in size. Wild hay, alfalfa, barley and oats are the principle farm crops. Garden City, located within the County is known for its raspberries, with a raspberry festival held every August attracting hundreds of tourists throughout the region.

Rich County is also known for its recreation spots including the Wasatch National Forest, Bear Lake State Park, and Rendezvous Beach State Park. Bear Lake, once called the Sea of Silence, invites vacationers of all types to its beaches. In the summer, water skiing, sailing, swimming, fishing, and camping are popular activities, and in the winter months, snowmobiling, tubing, and ice fishing are popular.

Rich County has none of the industrial, educational or cultural assets of Box Elder or Cache Counties. Bear Lake has carried this sparsely populated county's economy for some time. This economic picture is rounded out by a number of cattle ranches and agricultural farms which make up the other half of the picture. Generally speaking, this area survives based on its service

community associated with summer and winter recreational seasons. A definite lack of diversity in its economy has led Rich County to a relatively flat growth rate, which in recent years has actually been negative. The recreational potential is still strong and the recreation needs of increasing numbers of Wasatch Front residents and Cache Valley residents will provide increased demand for the recreational assets found in Rich County. The County is also subject to dramatic seasonal population shifts due to "Snow birds", and an under-utilized winter season. (See the “Population Density and “Land Ownership” map in the map section of the county annex).

Table IV-48: Rich County Participating PDM Jurisdictions			
Rich County	Garden City	Laketown	Woodruff

RICH COUNTY FLOODING

Background

The flood risk for Rich County is minimal. The county is sparsely populated and the communities are generally not located near a flood source. The Bear River passes through Rich County in an area with some agricultural use. It flows primarily through rural areas with little or no development.

All of the four incorporated cities in Rich County have small streams that pass through the communities. These communities have historically experienced minimal impacts from flooding.

The southern half of Bear Lake is located in Rich County. A great deal of beach front development has occurred along the shores of Bear Lake. The rising lake level has rarely threatened lakeshore development but some flood of homes has occurred. Pacificorp operates a hydroelectric facility on the lake and has purchased some of the flood prone lakeshore properties to mitigate the impact of high lake level flooding.

History of Flooding in Rich County

Table IV-49: Rich County Flood History 1847-2003		
Location	Date	Description
Randolph	1955	Flooding caused the closure of the Highway.
	Spring 1983	Damage to roads, culverts & bridges. Some homes flooded and crop damage.
Woodruff	Spring 1983	Damage to roads, culverts & bridges. Some homes flooded and crop damage.
Local Surveys (see appendix A) (Butler & Marsell, 1972), (Division of Comprehensive Emergency Management, 1981)		

Rich County Flood Hazard Assessment
Hazard Profile

Frequency	Infrequent
Severity	Moderate
Location	Generally along rivers, streams and canals.
Seasonal Pattern	Spring flooding as a result of snowmelt. Mid-late summer cloudburst events.
Duration	A few hours or up to three weeks for snowmelt flooding
Speed of Onset	1-6 hours
Probability of Future Occurrences	Moderate-for delineated flood plains there is a 1% chance of flooding in any given year.

In Rich County, only Woodruff Town has a delineated flood plain.
An August 2003 report Flood Hazard Identification Study: Bear River Association of Governments by the U.S. Army Corps of Engineers was used to determine flood risk for communities that do not have FEMA Firm flood plain maps (See Appendix B for full report).

In **Unincorporated Rich County** what development does exist near the Bear River (isolated farmsteads) has potential flood risk and to some extent development around Bear Lake.

Portions of **Garden City** have some risk of flooding from the Garden City Canyon drainage and to a lesser extent the smaller drainages to the south and north.

Randolph City has some flood threat from the Little Creek drainage. The upstream Little Creek Reservoir may help moderate this risk.

Woodruff City has flood risk from the Genes Creek and Dry Creek drainages.

Assessing Vulnerability: Identifying Assets & Estimating Losses

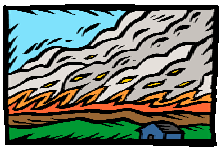
Very minimal property is at risk of flooding in Rich County. Even agricultural impacts are minimal when the Bear River flood because most the adjacent use is grazing land that can adapt to higher flows. With the exception of Woodruff Town, the lack of flood plain data makes it very difficult to pinpoint potential specific impact areas. However, based on local experience the potential impacts are negligible.

Woodruff Town is the only Rich County community that has a flood plain map. Base on GIS overlay analysis, approximately nineteen housing units or fifty persons are located in the 100 year flood plain. It is estimated that $1,425,397 in residential property is at risk.

Assessing Vulnerability: Analyzing Development Trends

Most of the growth in terms of new development is occurring in Garden City and to a lesser extent Laketown. Most of this new development is second home housing associated with the Bear Lake recreation area. A great deal of this development is on the hillsides above Garden City proper. Some risk of flooding is possible as this development encroaches on drainages.

New development on the Lakeshore could also increase the property at risk. However this risk is somewhat minimal.



RICH COUNTY WILDFIRES

Background

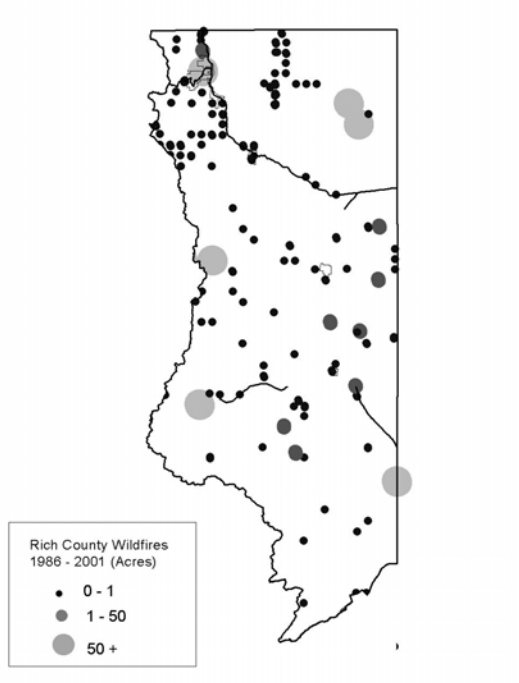
Wildfires occur with some frequency in Rich County. The vast majority occur in areas that are predominately sage and scrub vegetation on BLM owned land. Most fires rarely threaten human safety or property and are often allowed to burn. The primary conflict area in terms of threat to property as it related to wildfire are areas above Garden City town proper, in mostly secondary home developments associated with the Bear Lake Recreation area. Some of these homes are built in heavily timbered areas.

Portions of the Cache National Forest are located in western Rich County. Transitioning down slope from the forest into the Bear Lake Valley and Garden City a significant number of cabins are located in Garden City above the traditional town center. Some of these homes are built in heavy vegetation and timber. Many are surrounded by lower sage type vegetation.

These areas are at risk from wildfire originating in the Forest Service managed land to the west and also human caused fire through or below the development. Much of this development is bisected by U.S 89 as it makes its rather steep decent into Garden City from Cache County. Sparks caused by overheating brakes on heavy trucks have been known to start fires adjacent to the road. In the right conditions, these types of fires can quickly spread to portions of the Bridgerland development and others. **See the "Wildfire Hazard" Map in the county annex map section.**

History of Wildfires in Rich County

The following graphic illustrates the number and rough locations of wild fires in Rich County in the 15 year period from 1986 to 2001.



Rich County Wildfire Hazard Assessment
Hazard Profile

Frequency	Annually (to some extent)
Severity	Moderate
Location	Dispersed throughout the whole county
Seasonal Pattern	Generally the worst from early July to mid September (depends on drought conditions)
Duration	A few hours to two weeks
Speed of Onset	1-6 hours
Probability of Future Occurrences	High (Based on data from 1986-2001, there is a 24% chance a fire of at least 1000 acres will occur every year)

Located in **Garden City** above the historic town core are a number of mostly secondary homes located in areas at some risk from wildfire. Most of the developed land is characterized by rather steep slopes with limited access and inadequate water supplies. Most homes do not have defensible space around them. Many of these homes are built with flammable building materials and do not adhere to "firewise" construction techniques.

Adequate fire response is a problem for these areas. Garden City maintains an all volunteer fire department. Heavy tanker trucks would only be able to crawl up the steep road grade of U.S. 89 to respond to a fire. Although only a few miles away, response times for some areas can be over 30 minutes in drive time alone.

Representing one of the largest developments, the Bridgerland Village property owners have formed a community fire planning team and developed a community fire plan.

Assessing Vulnerability: Identifying Assets & Estimating Losses

Table IV-50: Rich County Wildfire Risk Residential and Commercial

Jurisdiction Name	Population	Residential Development at Risk		Commercial Development at Risk (x 1000)	
		Units	Value	Units	Income*/Structures**
Garden City (Bridgerland Village)	331 Mostly Part Time	102 Cabins	$15,500,000		

Population and Residential Development estimates are derived using 2000 Census data
*****2002 estimated total sales revenue (Census)
** Based on average 2002 assessed commercial building value for Cache County
(2002 State Tax Commission Report & Cache County Assessor's Office)
Note: Communities not listed have no residential or commercial property identified in the hazard.

Assessing Vulnerability: Analyzing Development Trends

The secondary recreational home market is predicted to remain strong for areas around Bear Lake (Garden City & Laketown). New problems will occur as more homes are built in fire prone areas. Many parcels are currently subdivided and for sale in high fire risk areas.

A rather large second home development (100+ lots) is working its way through Rich County planning approval about 12 miles west of Woodruff town on the Monte Cristo road (Hwy 39). It's likely the county will require the provision of fire equipment on-site and trained emergency response personnel.

RICH COUNTY LANDSLIDES

Background

The potential for impacts related to landslides is minimal in Rich County. **See the "Landslide Potential" Map in the county annex map section.**

History of Landslides in Rich County

Table IV-51: Rich County Landslide Areas	
Active Landslides (in Acres)	Historically Active Landslides 1847 to present (in Acres)
0	69,196

The steeper slopes of the Bear River Mountains on the west side of the county as they descend into the Bear Lake Valley have indications of historical landslide activity. Much of this area is where summer cabins are located.

Rich County Landslide Hazard Assessment
Hazard Profile

Frequency	Infrequent
Severity	Moderate
Location	Mainly on Steeper slopes above Garden City in the Bear River Mountains.
Seasonal Pattern	Generally the worst in the wetter spring months.
Duration	Up to two weeks
Speed of Onset	No warning
Probability of Future Occurrences	Low

Assessing Vulnerability: Identifying Assets & Estimating Losses

Table IV-52: Rich County Landslide Risk Residential and Commercial (Active & Historically Active Landslides)					
Jurisdiction Name	**Population**	**Residential Development at Risk**		**Commercial Development at Risk (x 1000)**	
		Units	**Value**	**Units**	**Income*/Structures****
Garden City	51	85	$9,309,625	2	$1,100/$294
Unincorporated	13	54	5,924,444		

Population and Residential Development estimates are derived using 2000 Census data
*****2002 estimated total sales revenue (Census)
** Based on average 2002 assessed commercial building value for Cache County
(2002 State Tax Commission Report & Cache County Assessor's Office)
Note: Communities not listed have no residential or commercial property identified in the hazard.
Data does not include areas susceptible to debris flows (no data available)

Table IV-53: Rich County Landslides Other Facilities at Risk (Active & Historically Active Landslides)				
Jurisdiction Name	**Critical Facilities**	**Roads**	**Power lines**	**Rail Lines**
Garden City		6.1miles/$18,910,000		
Unincorporated		12.2miles/$37,820,000	0.8miles/$38,608	
See Appendix D for data sources and cost factors. **Note: Jurisdictions not listed have no identified facilities at risk.**				

Assessing Vulnerability: Analyzing Development Trends

More construction on the steeper slopes above Garden City and south of Garden City could be problematic.

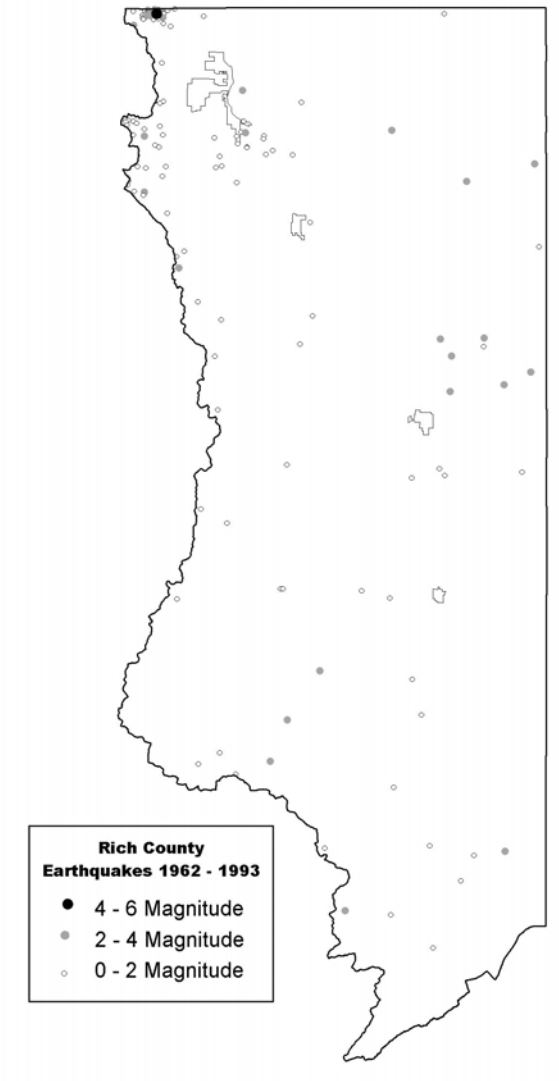
RICH COUNTY EARTHQUAKES

Background

Although not as seismically active as Box Elder and Cache Counties, Rich County does have recorded seismic activity. The predominate and most active faulting is the Bear Lake Fault on the east side of Bear Lake. **See the "Earthquake Fault Zone" Map in the county annex map section.**

History of Earthquakes in Rich County

On November 9, 1884 the Bear Lake Valley experienced an estimated 6.3 magnitude earthquake with the epicenter near Paris, Idaho followed by aftershocks of 2.3 magnitute. The earthquake was felt as far as Ogden.



Rich County Earthquake Hazard Assessment
Hazard Profile

Frequency	Occasional
Severity	Moderate
Location	Entire County with highest frequency in the Bear River Mountain Range. Surface fault ruptures are likely to occur in fault zones on the East Shore of Bear Lake.
Seasonal Pattern	None
Duration	A few minutes with potential aftershocks
Speed of Onset	No warning
Probability of Future Occurrences	Based on 1962-1993 data, there is a 10% chance every year of an earthquake of 3.0 magnitude or greater.

Kalliser indicates that the Bear Lake Fault is active with evidence of large earthquakes in the recent past. He reports a continuous like of scarplets in recent sediments on the east shore of the lake. In addition, the delta fans at the mouth of North and South Eden Canyons are displaced by faulting.

Some faulting has been reported by fathograms in the bottom of Bear Lake.

Assessing Vulnerability: Identifying Assets & Estimating Losses

The analysis did not document any impacts from liquefaction or fault zones to residential or commercial development in Rich County.

Table IV-54: Rich County Earthquakes (Fault Zone) Other Facilities at Risk

Jurisdiction Name	Critical Facilities	Roads	Power lines	Rail Lines
Laketown		0.2miles/$620,000		
Unincorporated		6.9miles/$21,390,000	0.1/$4,826	

See Appendix D for data sources and cost factors.
Note: Jurisdictions not listed have no identified facilities at risk.

Rich County HAZUS Analysis

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates can be used by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The results of the model ran for Rich County simulates a 2,500 year event with an earthquake magnitude of 7.0.

Table IV-55: Rich County Human Casualty Estimates (HAZUS Model 7.0 Magnitude Earthquake)					
Timing	Sector	Level 1	Level 2	Level 3	Level 4
2 A.M	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	1	0	0	0
	Industrial	0	0	0	0
	Residential	5	1	0	0
	Single Family	6	1	0	1
	Total	12	2	0	1
2 P.M.	Commercial	4	1	0	0
	Commuting	0	0	0	0
	Educational	3	1	0	0
	Hotels	0	0	0	0
	Industrial	1	0	0	0
	Residential	1	0	0	0
	Single Family	1	0	0	1
	Total	10	2	0	1
5 P.M.	Commercial	5	1	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Residential	2	0	0	0
	Single Family	2	1	0	1
	Total	9	2	0	1

Severity Level 1: Injuries will require medical attention buy hospitalization is not needed.
Severity Level 2: Injuries will require hospitalization buy are not considered life-threatening.
Severity Level 3: Injuries will require hospitalization and can become life threatening in not promptly treated.
Severity Level 4: Victims are killed by the earthquake.

Table IV-56: Rich County Building-Related Economic Loss Estimates in $ Millions (HAZUS Model 7.0 Magnitude Earthquake)							
Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Loses	Wage	0	.20	.27	.01	.01	.48
	Capital-Related	0	.08	.24	0	0	.34
	Rental	.90	.61	.16	0	0	1.66
	Relocation	.08	.02	.01	0	0	.11
	Subtotal	.98	.91	.68	.01	.01	2.59
Capital	Structural	4.38	1.57	.46	.06	.07	6.55

Table IV-56: Rich County Building-Related Economic Loss Estimates in $ Millions (HAZUS Model 7.0 Magnitude Earthquake)							
Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Stock Loses	Non-structural	15.38	5.93	1.08	.18	.11	22.69
	Content	3.83	1.07	.48	.10	.07	5.54
	Inventory	0	0	.02	.02	0	.04
	Subtotal	23.59	8.57	2.04	.36	.26	34.82
	Total	24.57	9.48		.37	.27	37.41

Table IV-57: Rich County Transportation System Loss Estimates in $ Millions (HAZUS Model 7.0 Magnitude Earthquake)			
System	Component	Inventory Value	Economic Loss
Highway	Segments	398	0
	Bridges	5	0
	Subtotal	403	0
Railways	Segments	0	0
	Bridges	0	0
	Subtotal	0	0
Airport	Facilities	0	0
	Runways	0	0
	Subtotal	0	0
	Total	403	0

Table IV-58: Rich County Transportation System Loss Estimates in $ Millions (HAZUS Model 7.0 Magnitude Earthquake)				
Classification	Total	Least Moderate Damage > 50%	Complete Damage > 50%	Functionality >50% at day 1
Hospitals	0	0	0	0
Schools	3	0	0	0
Police Stations	2	0	0	0
Fire Stations	3	0	0	0

Table IV-59: Rich County Expected Building Damage by Occupancy (HAZUS Model 7.0 Magnitude Earthquake)										
	None		Slight		Moderate		Extensive		Complete	
	Count	%	Count	%	Count	%	Count	%	Count	%
Agriculture	0	0	0	0	0	0	0	0	0	0
Commercial	0	0	1	.10	1	.1	1	.2	0	.31
Education	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0

Table IV-59: Rich County Expected Building Damage by Occupancy (HAZUS Model 7.0 Magnitude Earthquake)										
	None		Slight		Moderate		Extensive		Complete	
	Count	%	Count	%	Count	%	Count	%	Count	%
Residential	25	6.3	74	12	181	30	163	62	57	62
Single Family	385	93.7	539	87.9	410	69.9	98	37.8	36	38
Total	410		614		592		261		93	

Assessing Vulnerability: Analyzing Development Trends

New lakeshore development on the east shore will be located near the Bear Lake Fault.

RICH COUNTY DAM FAILURE

Background

There are 525 regulated dams located in Rich County. Most of these dams are small detention ponds, small agricultural reservoirs or livestock watering facilities and most pose a minimal threat to human safety or property.

Of the 525 regulated dams 518 are designated as “low hazard” by the State of Utah Division of Water Rights. As defined by state statue, low hazard dams are those dams which, if they fail, would cause minimal threat to human life, and economic losses would be minor or limited to damage sustained by the owner of the structure.

A total of 5 dams have been designated as “moderate hazard” by the State of Utah in Rich County. Moderate Hazard dams which, if they fail, have a low probability of causing loss of human life, but would cause appreciable property damage, including damage to public utilities.

The State of Utah has rated 2 dams in Rich County as “high hazard” which means that, if they fail, have a high probability of causing loss of human life or extensive economic loss, including damage to critical public utilities.

Dam failure inundation maps and emergency action plans for each of the high risk dams can be found on the Utah Division of Water Right’s website at: http://waterrights.utah.gov/cgi-bin/damview.exe?Startup.

History of Dam Failure in Rich County

No significant dam failures have occurred in Rich County.

Rich County Dam Failure Hazard Assessment
Hazard Profile

Frequency	Rare
Severity	Potentially Catastrophic
Location	Areas down stream of failed dam.
Seasonal Pattern	Anytime. Highest risk in spring during snowmelt.
Duration	A few hours
Speed of Onset	No warning
Probability of Future Occurrences	Low

Assessing Vulnerability: Identifying Assets & Estimating Losses

Woodruff Creek Dam

The Woodruff Creek Dam is a high hazard rating facility which lies nine miles east and upstream from the town of Woodruff. The inundation area follows Woodruff Creek covering the valley

bottom as it moves downhill. Once out of the canyon, the inundation area widens significantly, covering the entire town of Woodruff before ending at the Bear River.

Assessing Vulnerability: Analyzing Development Trends

Any new downstream development that is located in the floodplain increases the exposure to risk in terms of human life and property. Given the relatively low probability of catastrophic dam failures, most jurisdictions are unwilling to regulate development in dam failure inundation areas.

RICH COUNTY HAZARD MITIGATION STRATIGIES

Hazard Mitigation Goals

The following goals were identified to direct the county's hazard mitigation strategies. These general goals were identified and developed based on the local official surveys (See appendix A), input from the Bear River District PDM Technical Planning Team and Steering Committee.

Goal # 1: Minimize potential impacts for future development

- **Develop, refine and improve the hazard data available to local level decision makers.**
- **As appropriate, develop and implement regulatory mechanisms to insure new development activities will not increase the risk to life or property.**
- **Build technical capacity for local elected and appointed officials.**
- **Empower citizens to make informed choices.**

Goal # 2: Minimize potential impacts for existing development

- **Improve emergency disaster response capabilities.**
- **Improve the disaster resistance of existing infrastructure and critical facilities.**
- **Educate and build capacity of citizens to undertake mitigation activities.**

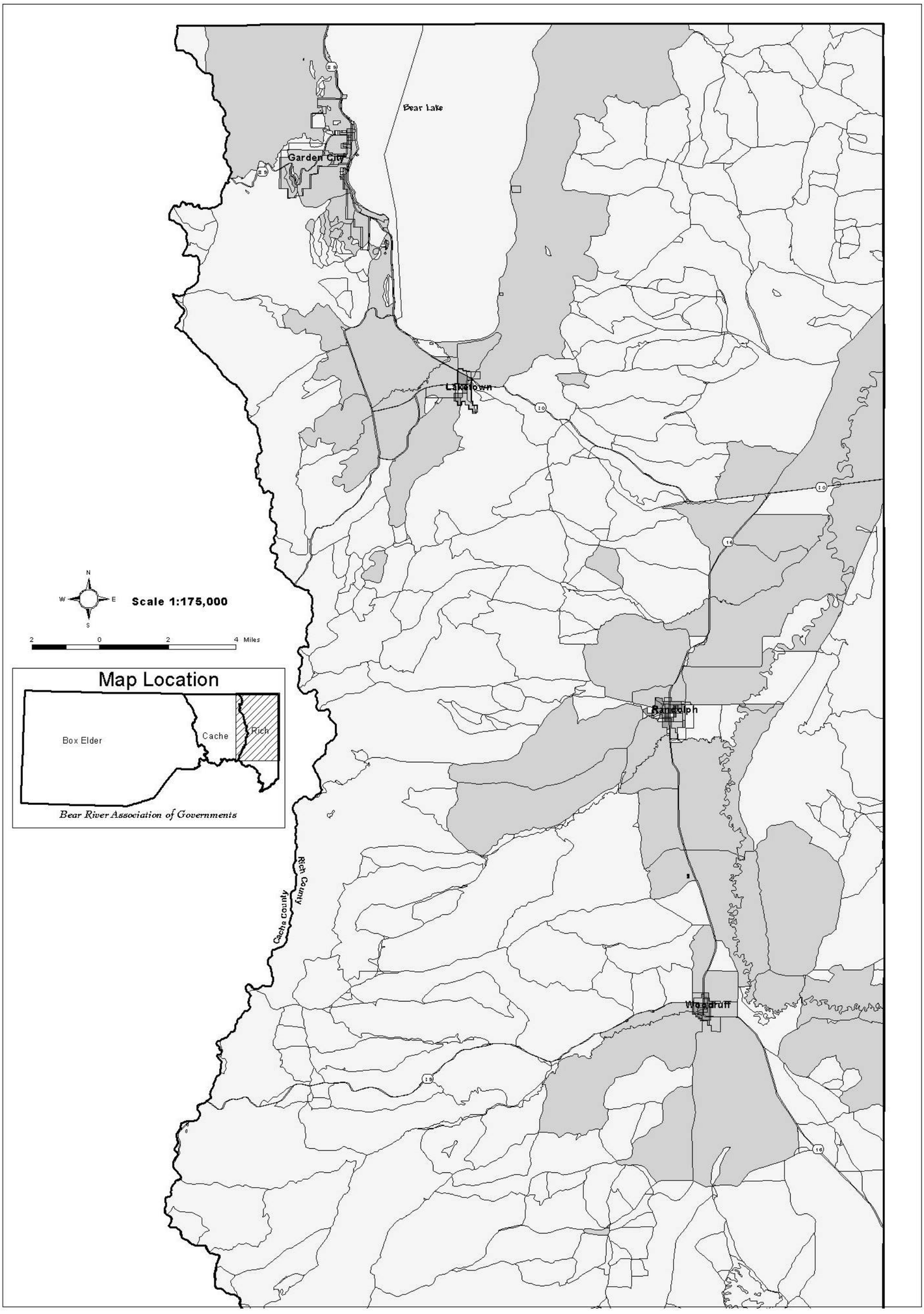
To accomplish these goals specific mitigation strategies were developed by participating jurisdictions. These goals were given assigned a priority of high, medium, or low by Bear River District PDM Technical Planning Team and Steering Committee. Priorities were give taking into account the following factors:

- Number of people protected by the project
- Technical feasibility
- Political support
- Environmental impacts
- Available funding source

A guiding factor in prioritizing mitigation was the though that mitigation should provide the greatest amount of good to the greatest amount of people when cost was taken into account. Prioritizing mitigation was difficult in this plan as each as Bear River is vulnerable to many different hazards. Each with its own characteristics. Thus, recurrence intervals, past events, damage estimates compiled during the assessing vulnerability section of this plan were also taken into account.

RICH COUNTY NATURAL HAZARD MITIGATION PROJECTS Bear River District Pre-Disaster Mitigation Plan 2004									
Hazard	**Goal**	**Jurisdiction(s)**	**Objective**	**Project Description**	**Priority**	**Timeframe**	**Potential Funding**	**Estimated Cost**	**Resources**
Multi-Hazard	**Goal 2**	**All Jurisdiction**	**Prepare for Severe Weather Events**	**Become a National Weather Service "Storm Ready" Community (http://www.stormready.noaa.gov/)**	**Medium**	**2006**		**Minimal**	**NOAA**
Flooding	**Goal 1 & 2**	**Woodruff, Laketown**	**Mitigate impacts related to flooding.**	**Initiate participation in the National Flood Insurance Program (NFIP) to enable home owners to purchase flood insurance.**	**High**	**2005**		**Minimal**	**UDESHS, ACOE**
Flooding	**Goal 1 & 2**	**Jurisdictions with identified flood hazards**	**Make better informed decisions.**	**Develop a floodplain map for communities that do not have one. Refine, update and improve existing flood plain mapping.**	**Medium**	**2009**	**FEMA, UDESHS, Local**	**$2,500 to $65,000 each**	**Consultants, FEMA, UDESHS, Public Works**
Wildfire	**Goal 2**	**Garden City, Unincorporated Rich County**	**Become "Firewise" communities.**	**Enact ordinance and planning procedures to insure development in fire prone areas are done wisely. Provisions for multiple access routes, firebreaks, wide roads and adequate water sources should be included. Standards for homes should be enforced that require defensible space and fire wise building materials and designs (see www.firewise.org).**	**High**	**2007**		**Minimal**	**BRAG, Utah Division of State Lands, Fire and Forestry, Utah League of Cities and Towns.**
Wildfire	**Goal 2**	**Garden City, Unincorporated Rich County**	**Build citizen capacity**	**Educate and train property owners in Wildland/Urban interface areas on how to protect their property from wildfire.**	**High**	**2006**	**Local**	**Minimal**	**BRAG, Utah Division of State Lands, Fire and Forestry, Utah League of Cities and Towns.**

PART IV-RICH COUNTY ANNEX HAZARD MAPPING



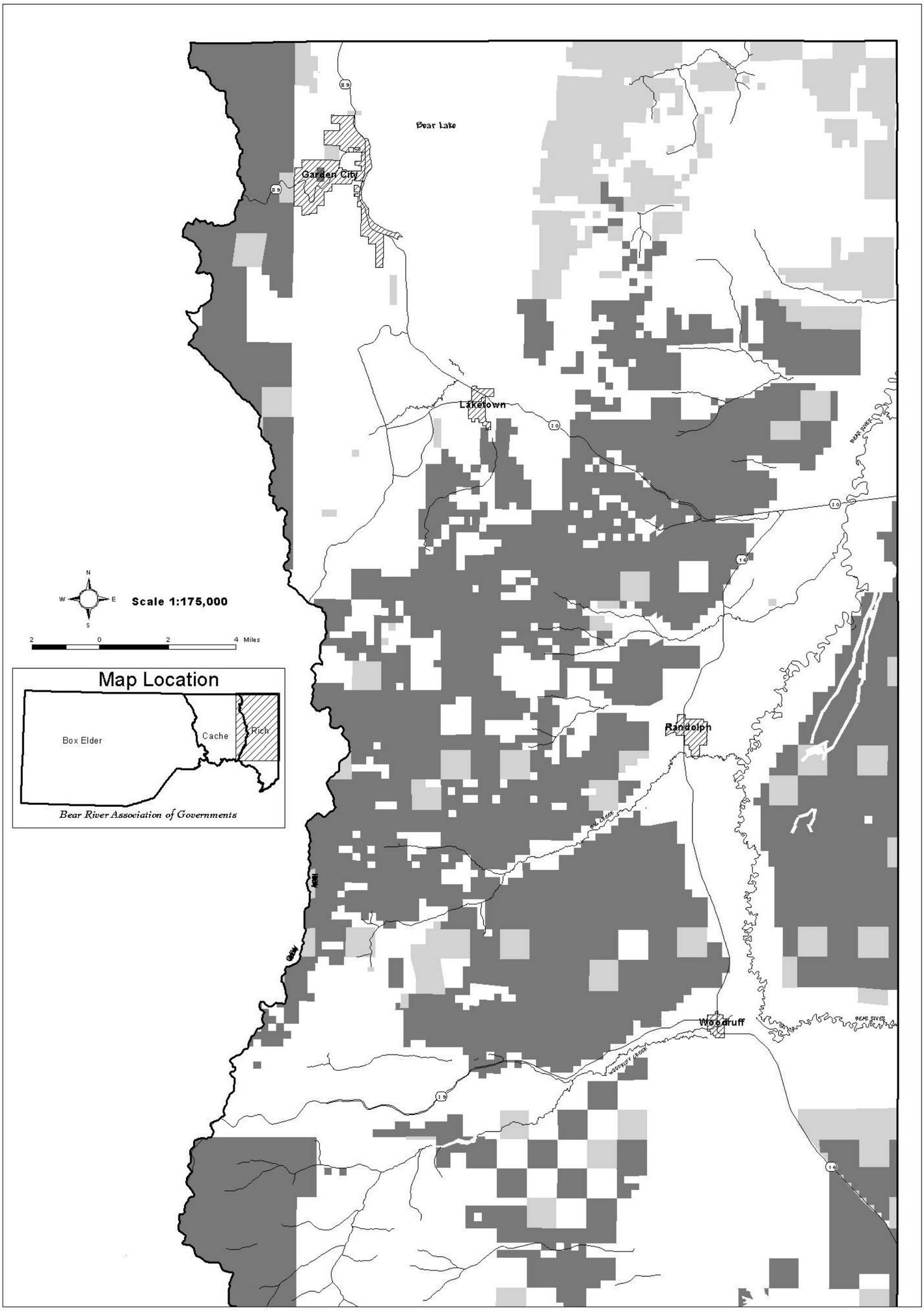
Rich County
Population Density

Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County boundries and population density from US Census.

Roads
Rivers
Rich County

Population Density (Persons per acre)
0
0 - 0.3
0.301 - 2
2.001 - 6
6.001 - 1000

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich



Rich County
Land Ownership

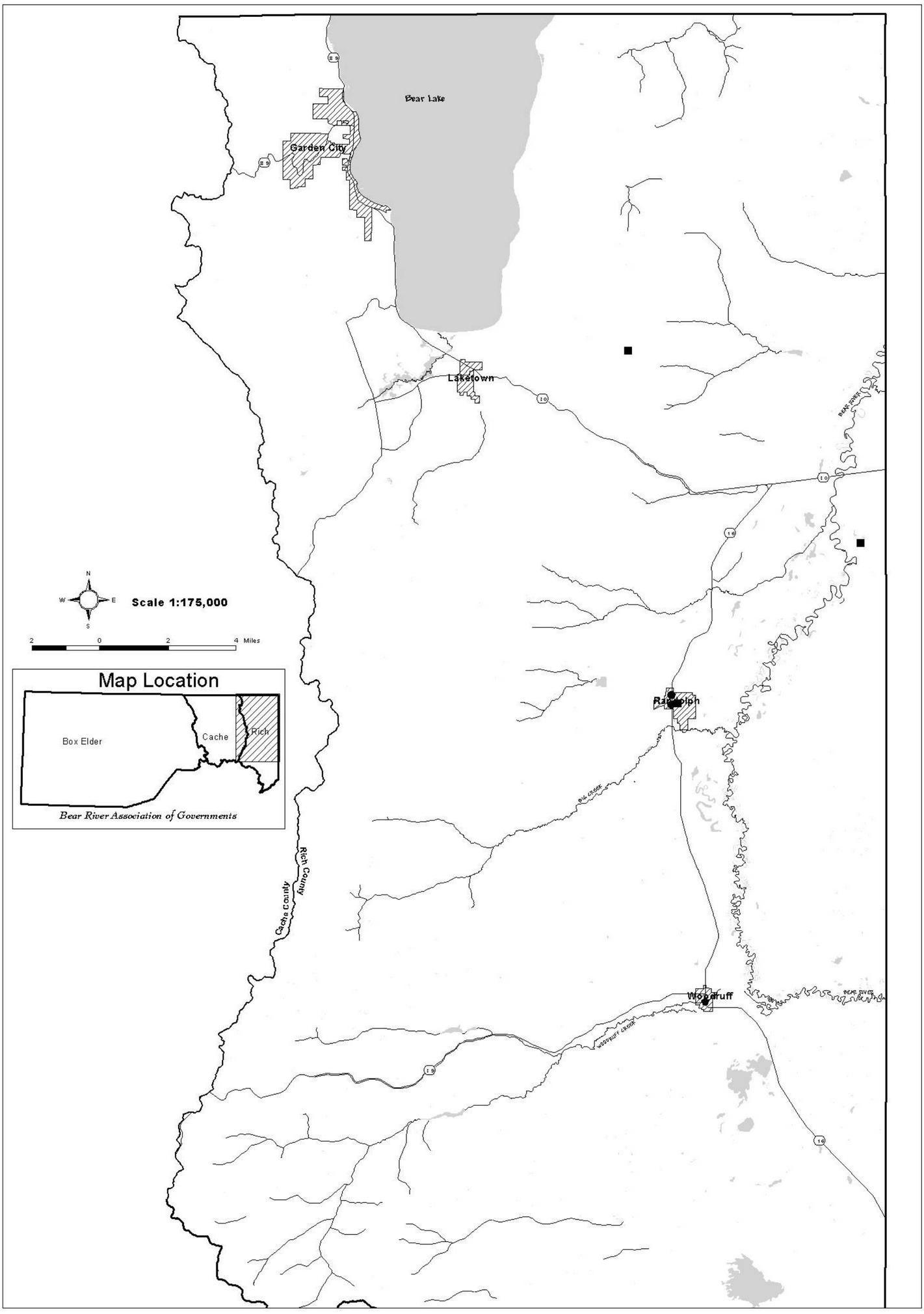
Data Source: Municipalities, ownership, roads, rivers and lakes maintained by Utah AGRC. County Boundries from U.S. Bureau of the Census.

The information on this map was derived from digital databases from BRAG GIS. Care was taken in the creation of this map but it is provided "as is." BRAG cannot accept any responsibility for any errors, omissions, or positional accuracy, and therefore, there are no warranties which accompany this product. Although information from a land survey may have been used in the creation of this product, in no way does this product represent a Land Survey. Users are cautioned to field verify information in this product before making any decisions.

Roads
Rivers
Cache County
Municipalities

Land Ownership
Private
State Lands
Federal Lands
Sovereign Lands

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich



Rich County

Critical Facilities

Roads
Rivers
Lakes
Municipalities
Police Station
School
Hospital
Fire Station
Rich County

Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County Boundries from US Census.

The information on this map was derived from digital databases from BRAG GIS. Care was taken in the creation of this map but is provided "as is." BRAG cannot accept any responsibility for any errors, omissions, or positional accuracy, and therefore, there are no warranties which accompany this product. Although information from a land survey may have been used in the creation of this product, in no way does this product represent a Land Survey. Users are cautioned to field verify information in this product before making any decisions.

BRAG
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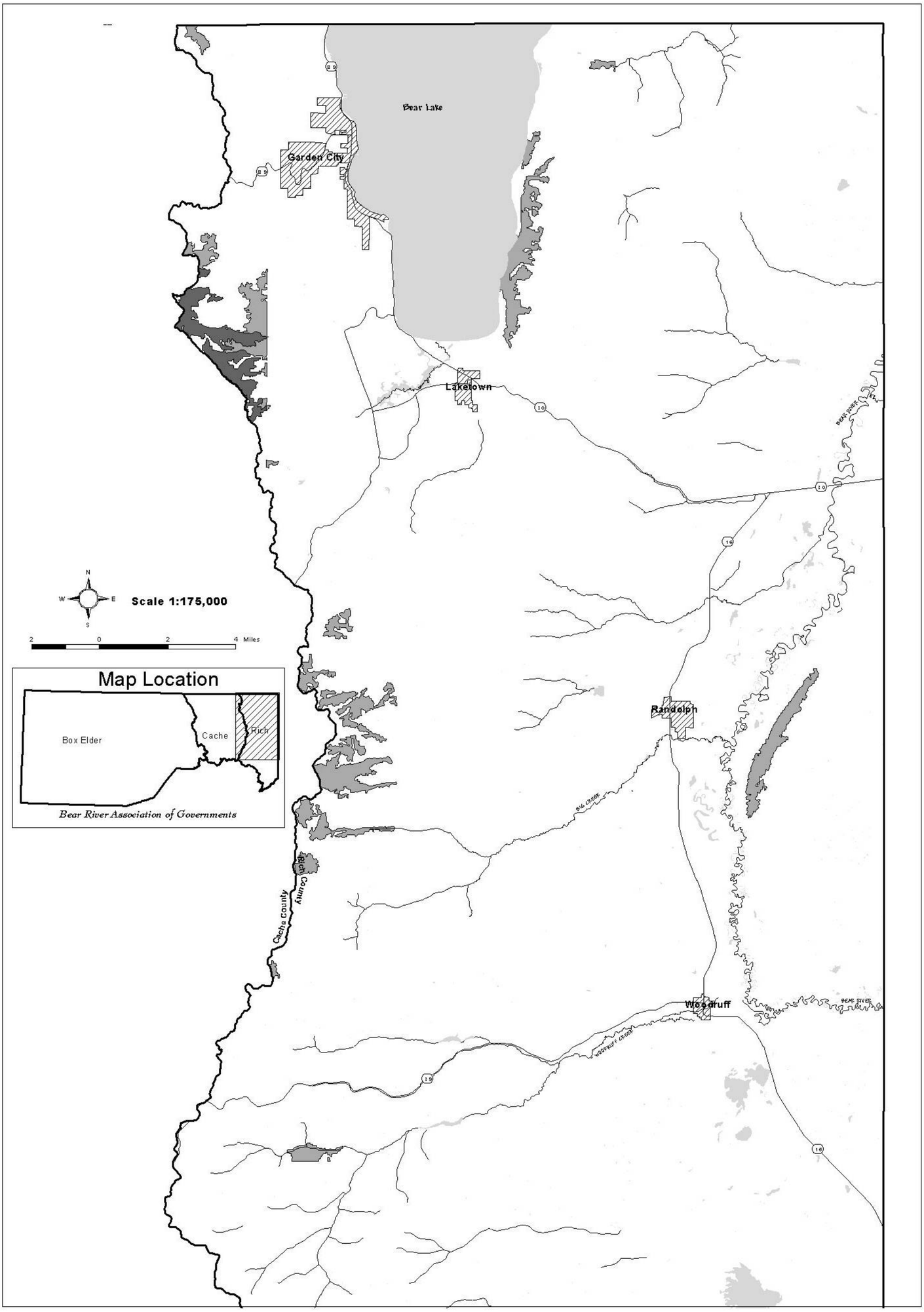
Box Elder
Cache
Rich



Rich County

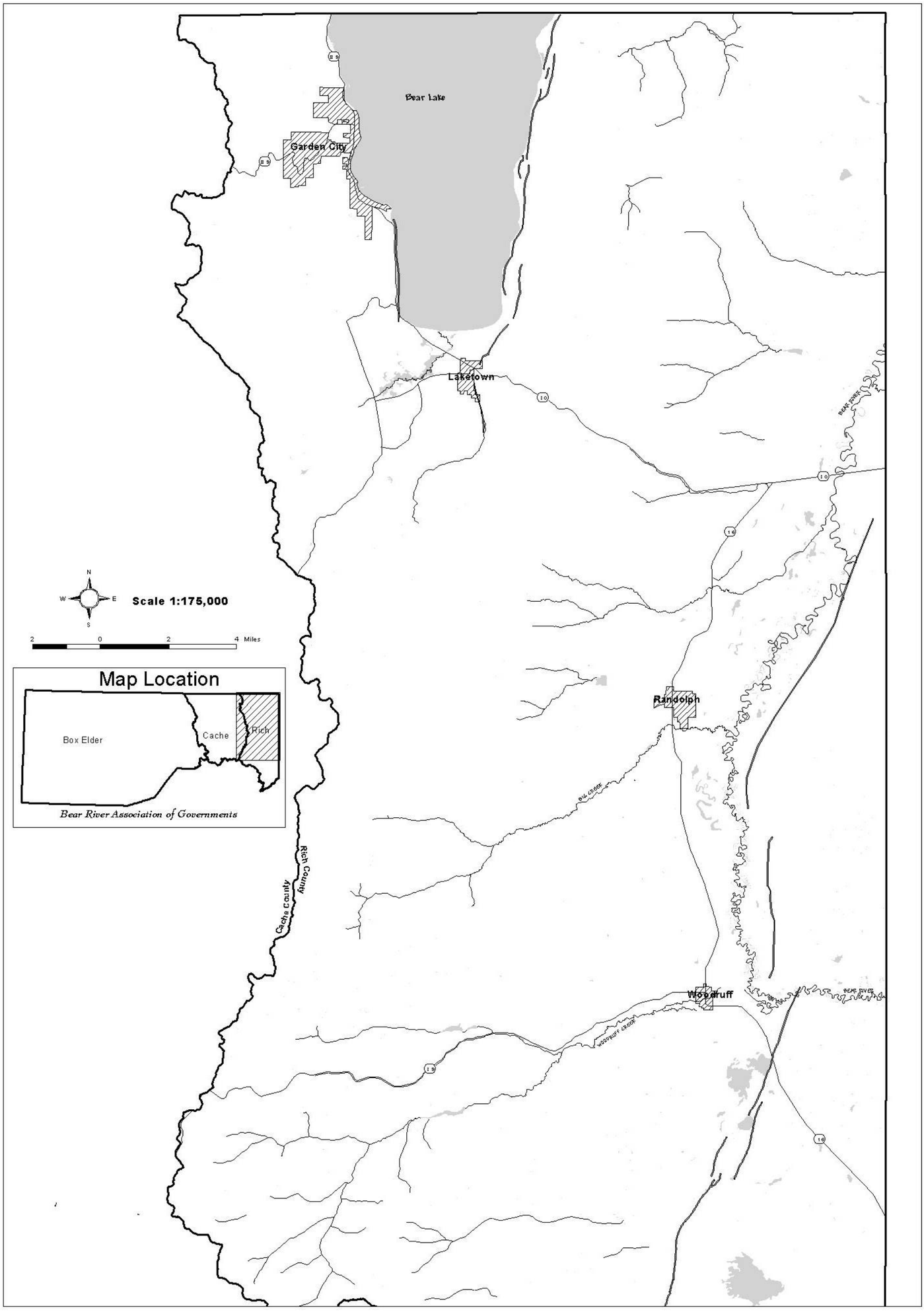
Wildfire Hazard

Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County boundries from US Census. Fire classes from BLM Firee Hazard Analysis

Roads
Rivers
Lakes
Municipalities
Moderate Fire Hazard
High and Extreme Fire Hazard
Rich County

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich

Landslide Missing



Rich County

Earthquake Fault Zone

Roads
Rivers
Lakes
100' Fault Zone
Municipalities
Rich County

Data Source: Municipalities, roads, rivers and lakes maintained by Utah AGRC. County Boundries from US Census. Fault zones derived from "Quaternary Tectonics of Utah" (Hecker, Utah Geological Survey Bulletin 127, 1993)

BRAG
Bear River Association of Governments
Box Elder
Cache
Rich

PART V: CAPABILITY ASSESSMENT

INTRODUCTION

What follows is a description of the organizational, technical and political capacity of the Bear River Region to implement hazard mitigation strategies and goals. The best plan in the world will do nothing to improve hazard mitigation efforts in the region without sufficient implementation capacity and capability; particularly local level capacity (town, city and county government). The purpose of this section is to analyze gaps and potential capability weaknesses for local level jurisdictions in the region.

LOCAL ORGANIZATIONAL AND TECHNICAL CAPABILITY

Only a handful of communities in the Bear River region have full time professional staff of any kind. In many cases a limited tax base means that hiring full time professional staff in the smaller cities and towns is financially unobtainable. Often these smaller communities rely on local volunteers or elected and appointed officials to perform many of the tasks normally handled by professional staff. It's not uncommon to have a volunteer city council persons or planning commissioner assigned the task of emergency management, grant writing or long range planning. Professional staff at BRAG (and each of the three counties to some degree) help provide some technical and planning assistance to these smaller communities. This regional assistance is often limited by staffing capacity and funding. As funding allows, some communities are able to contract for professional services from private consultants.

Only Logan City and Brigham City have staffs that are, for the most part, dedicated full time to emergency management related tasks. While Box Elder, Cache and Rich Counties have emergency managers, all of these individuals have other responsibilities in addition to core emergency management functions.

Table V-1: State and Regional Hazard Mitigation Resources
Bear River District

Agency/Group	Description
Utah Div. of Emergency Services and Homeland Security	Training, technical assistance and funding.
Utah League of Cities and Towns	Training, technical assistance and planning assistance
Utah Geologic Survey	Technical assistance, plan review
Bear River Association of Governments	Technical assistance, plan review, GIS and Community Development Block Grants.
Bear River Health Department	Emergency preparedness and response. Homeland security planning.
Cache Chapter of the American Red Cross	Training, emergency preparedness and response.
Utah Association of Conservation Districts	Technical assistance and planning assistance.

Table V-2: Local Level Hazard Mitigation Capability Bear River District		
Jurisdiction	**Professional Staffing (e.g. City Manger, Engineer, Planner)**	**Technical Capacity (In House)**
BOX ELDER COUNTY	County Emergency Management Coordinator (partial time), County Planner, Public Works, Building Inspector	GIS Staffing and equipment
Bear River City	Volunteer\contracted consultant	None
Brigham City	Full time Emergency Manager, Planning Department, Public Works	GIS Staffing and equipment
Corinne City	Part time City Manager	None
Deweyville Town	Volunteer\contracted consultant	None
Elwood Town	Volunteer\contracted consultant	None
Fielding Town	Volunteer\contracted consultant	None
Garland City	Volunteer\contracted consultant	None
Honeyville City	Volunteer\contracted consultant	None
Howell Town	Volunteer\contracted consultant	None
Mantua Town	Volunteer\contracted consultant	None
Perry City	Volunteer\contracted consultant	None
Plymouth Town	Volunteer\contracted consultant	None
Portage Town	Volunteer\contracted consultant	None
Snowville Town	Volunteer\contracted consultant	None
Tremonton City	City Manager, City Engineer	CAD capability
Willard City	Part Time Planning Administrator	Some GIS Capability
CACHE COUNTY	Countywide Planner, Emergency Manager	GIS Capability and staffing
Amalga Town	Volunteer\contracted consultant	None
Clarkston Town	Volunteer\contracted consultant	None
Cornish Town	Volunteer\contracted consultant	None
Hyde Park City	Volunteer Emergency Manager	Some GIS Capability
Hyrum City	Zoning Administrator\City Manager, City Engineer	Some GIS Capability
Lewiston City	Volunteer\contracted consultant	None
Logan City	Emergency Management Department, Planning Department, City Engineers & Public Works.	Advanced GIS capability with customized application to Emergency Management.
Mendon City	Volunteer\contracted consultant	None
Millville City	Part Time Planner	None
Newton Town	Volunteer\contracted consultant	None
Nibley City	City Manager/Planner	None
North Logan City	City Manager/Engineer, Planner	Some GIS Capability
Paradise Town	Volunteer\contracted consultant	None
Providence City	City Manager	None
Richmond City	Part Time City Manager	None
River Heights City	Volunteer\contracted consultant	None
Smithfield City	City Manager\Engineer	Some GIS Capability
Trenton Town	Volunteer\contracted consultant	None

Table V-2: Local Level Hazard Mitigation Capability Bear River District		
Jurisdiction	**Professional Staffing (e.g. City Manger, Engineer, Planner)**	**Technical Capacity (In House)**
Wellsville City	City Manager	None
RICH COUNTY	Countywide Planner (Bear Lake Regional Commission), Part-time Emergency Manager	Significant GIS capability
Garden City	Volunteer\contracted consultant	None
Laketown	Volunteer\contracted consultant	None
Randolph City	Volunteer\contracted consultant	None
Woodruff Town	Volunteer\contracted consultant	None

POLICY AND PROGRAM CAPABILITY

Of the thirty nine municipalities in the Bear River Region, thirty one have an adopted General Plan as required by state code. Although many communities have recently updated their General Plan, many are very outdated and have not been revised in years. Generally speaking, if these plans address natural hazards at all, it is usually limited to flood related hazards.

All of the thirty nine municipalities have an adopted zoning ordinance. Again, often these ordinances are outdated and often are not consistent with the jurisdiction's General Plan. Most zoning ordnances do not address natural hazards in any way. A few communities have a "sensitive area" or "hazard area" overlay zone. All communities issue building permits and enforce local building codes. Often this service is contracted for with the county.

Many of the smaller communities lack emergency response plans.

Of thirty nine municipalities and three counties, twenty four are participating in the National Flood Insurance Program (NFIP).

Authority

Federal: Public Law 93-288 as amended, established the basis for federal hazard mitigation activity in 1974. A section of this Act requires the identification, evaluation, and mitigation of hazards as a prerequisite for state receipt of future disaster assistance outlays. Since 1974, many additional programs, regulations, and laws have expanded on the original legislation to establish hazard mitigation as a priority at all levels of government. When PL 93-288 was amended by the Stafford Act, several additional provisions were also added that provide for the availability of significant mitigation measures in the aftermath of Presidentially declared disasters. Civil Preparedness Guide 1-3, Chapter 6- Hazard Mitigation Assistance Programs places emphasis on hazard mitigation planning directed toward hazards with a high impact and threat potential.

The Disaster Mitigation Act of 2000 was signed into Law on October 30, 2000. Section 322, defines mitigation planning requirements for state, local, and tribal governments. Under Section 322 States are eligible for an increase in the Federal share of hazard mitigation (HMGP), if they submit for approval a mitigation plan, which is a summary of local and/or regional mitigation plans, that identifies natural hazards, risks, vulnerabilities, and describes actions to mitigate the hazards, risks and vulnerabilities in that plan.

State: The State of Utah derives it's authority under the Emergency Management Act of 1981 (Utah Code 53-2, 63-5) as well as the Governor's Emergency Operations Directive and Executive Order of the Governor 11.

Association of Governments: The Association of Governments have been duly constituted under the authority of Title XI, Chapter13, Utah Code Annotated, 1953, as amended (The Inter-local Cooperation Act) and pursuant to Section 3 of the Executive Order of the Governor of the State of Utah, dated May 27, 1970, with the authority to conduct planning studies and to provide services to its constituent jurisdictions.

Local: Utah Code, Title 17, Chapter 27 is the County Land Use Development and Management Act that grants authority to counties. Utah Code, Title 10 Chapter 9 grants similar authority to municipalities.

PART VI: PLAN MAINTENENCE

PLAN MAINTANENCE PROCEDURE

Monitoring, Evaluating and Updating the Plan

Periodic monitoring and reporting of the Plan is required to ensure that the goals and objectives for the Bear River Region are kept current and that local mitigation efforts are being carried out.

Annual Reporting Procedures

The Plan shall be reviewed annually, as required by the BRAG Governing Board, or as situations dictate such as following a disaster declaration. The second quarter of each year the BRAG Community Development Department Staff will review the plan and ensure the following:

1. The Executive Director and the Governing Board will receive an annual report and/or presentation on the implementation status of the Plan.

2. The report will include an evaluation of the effectiveness and appropriateness of the mitigation actions proposed in the Plan.

3. The report will recommend, as appropriate, any required changes or amendments to the Plan.

If the BRAG Governing Board determines that a modification of the Plan is warranted, the Board may initiate a plan amendment.

Revisions and Updates

Periodic revisions and updates of the Plan are required to ensure that the goals and objectives for the Bear River Region are kept current. More importantly, revisions may be necessary to ensure the Plan is in full compliance with Federal regulations and State statutes. This portion of the Plan outlines the procedures for completing such revisions and updates.

Five (5) Year Plan Review

Every five years the plan will be reviewed and a complete update will be initiated. All information in the plan will be evaluated for completeness and accuracy based on new information or data sources. New property development activities will be added to the plan and evaluated for impacts. New or improved sources of hazard related data will also be included.

The goals, objectives and mitigation strategies will be readdress and amended as necessary based on new information, additional experience and the implementation progress of the plan. The approach to this plan update effort will be essentially the same as used for the original plan development.

Plan Amendments

Plan amendments will be considered by the BRAG Governing Board during the plan's annual review to take place the second quarter of each year. All affected local jurisdictions (cities, towns and counties) will be required to hold a public hearing and adopt the recommended amendment by resolution prior to consideration by the BRAG board.

IMPLEMENTATION THROUGH EXISTING PROGRAMS

Integration with Local Planning

This plan is only useful to the extent its recommendations and mitigation strategies are integrated into local level decision making, programs, regulations and resource allocation priorities. The jurisdiction's Comprehensive Plan and supporting regulatory ordinances are where many of the plan's recommendations would be implemented locally. Capital improvement planning and programming is where most jurisdictions address the resource allocation and funding issues (this process generally coincides with the jurisdiction's budget approval process).

In the preparation of this plan it soon became very evident that, for most elected and appointed officials in the Bear River District, there is a strong desire to improve the jurisdiction's handling of natural hazard related issues. Many expressed a level of concern together with recognition that their jurisdiction is not appropriately dealing with natural hazard issues and may be unknowingly placing people and property at risk. For many cities and towns, particularly the smaller ones, lack of motivation is not the issue. Knowing what to do and how to move forward is.

Integration of the recommendations of this plan with local level planning and land use decision making will most effectively be accomplished by education, training and effective technical assistance. Enhanced communication and collaboration with other cities, towns and counties in the region will help move the plan into the implementation phase.

Specifically, BRAG proposes to move the implementation phase forward by:

1) Establishing, coordinating and hosting county hazard mitigation working groups that would meet at least quarterly.
2) Develop and host a natural hazard mitigation implementation workshop for the region within three months of local adoption of the plan.
3) Provide on-going technical assistance to cities and towns.

Potential Funding Sources

Although all mitigation techniques will likely save money by avoiding losses, many projects are costly to implement. The Bear River jurisdictions will continue to seek outside funding assistance for mitigation projects in both the pre- and post-disaster environment. This portion of the Plan identifies the primary Federal and State grant programs for Bear River jurisdictions to consider, and also briefly discusses local and non-governmental funding sources.

Federal

The following federal grant programs have been identified as funding sources which specifically target hazard mitigation projects:

Title: Pre-Disaster Mitigation Program
Agency: Federal Emergency Management Agency

Through the Disaster Mitigation Act of 2000, Congress approved the creation of a national program to provide a funding mechanism that is not dependent on a Presidential Disaster Declaration. The Pre-Disaster Mitigation (PDM) program provides funding to states and communities for cost-effective hazard mitigation activities that complement a comprehensive mitigation program and reduce injuries, loss of life, and damage and destruction of property.

The funding is based upon a 75% Federal share and 25% non-Federal share. The non-Federal match can be fully in-kind or cash, or a combination. Special accommodations will be made for "small and impoverished communities", who will be eligible for 90% Federal share/10% non-Federal.

FEMA provides PDM grants to states that, in turn, can provide sub-grants to local governments for accomplishing the following eligible mitigation activities:

State and local hazard mitigation planning
Technical assistance (e.g. risk assessments, project development)
Mitigation Projects
Acquisition or relocation of vulnerable properties
Hazard retrofits
Minor structural hazard control or protection projects
Community outreach and education (up to 10% of State allocation)

Title: Flood Mitigation Assistance Program
Agency: Federal Emergency Management Agency

FEMA's Flood Mitigation Assistance program (FMA) provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes and other structures insurable under the National Flood Insurance Program (NFIP). FMA was created as part of the National Flood Insurance Reform Act of 1994 (42 USC 4101) with the goal of reducing or eliminating claims under the NFIP.

FMA is a pre-disaster grant program, and is available to states on an annual basis. This funding is available for mitigation planning and implementation of mitigation measures only, and is based upon a 75% Federal share/25% non-Federal share. States administer the FMA program and are responsible for selecting projects for funding from the applications submitted by all communities within the state. The state then forwards selected applications to FEMA for an eligibility determination. Although individuals cannot apply directly for FMA funds, their local government may submit an application on their behalf.

Title: Hazard Mitigation Grant Program
Agency: Federal Emergency Management Agency

The Hazard Mitigation Grant Program (HMGP) was created in November 1988 through Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistant Act. The HMGP assists states and local communities in implementing long-term mitigation measures following a Presidential disaster declaration.

To meet these objectives, FEMA can fund up to 75% of the eligible costs of each project. The state or local cost-share match does not need to be cash; in-kind services or materials may also be used. With the passage of the Hazard Mitigation and Relocation Assistance Act of 1993, federal funding under the HMGP is now based on 15% of the federal funds spent on the Public and Individual Assistance programs (minus administrative expenses) for each

disaster.

The HMGP can be used to fund projects to protect either public or private property, so long as the projects in question fit within the state and local governments overall mitigation strategy for the disaster area, and comply with program guidelines. Examples of projects that may be funded include the acquisition or relocation of structures from hazard-prone areas, the retrofitting of existing structures to protect them from future damages; and the development of state or local standards designed to protect buildings from future damages.

Eligibility for funding under the HMGP is limited to state and local governments, certain private nonprofit organizations or institutions that serve a public function, Indian tribes and authorized tribal organizations. These organizations must apply for HMPG project funding on behalf of their citizens. In turn, applicants must work through their state, since the state is responsible for setting priorities for funding and administering the program.

Title: Public Assistance (Infrastructure) Program, Section 406
Agency: Federal Emergency Management Agency

FEMA's Public Assistance Program, through Section 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, provides funding to local governments following a Presidential Disaster Declaration for mitigation measures in conjunction with the repair of damaged public facilities and infrastructure. The mitigation measures must be related to eligible disaster related damages and must directly reduce the potential for future, similar disaster damages to the eligible facility. These opportunities usually present themselves during the repair/replacement efforts.

Proposed projects must be approved by FEMA prior to funding. They will be evaluated for cost effectiveness, technical feasibility and compliance with statutory, regulatory and executive order requirements. In addition, the evaluation must ensure that the mitigation measures do not negatively impact a facility's operation or risk from another hazard.

Public facilities are operated by state and local governments, Indian tribes or authorized tribal organizations and include:

*Roads, bridges & culverts
*Draining & irrigation channels
*Schools, city halls & other buildings
*Water, power & sanitary systems
*Airports & parks

Private nonprofit organizations are groups that own or operate facilities that provide services otherwise performed by a government agency and include, but are not limited to the following:

*Universities and other schools
*Hospitals & clinics
*Volunteer fire & ambulance
*Power cooperatives & other utilities
*Custodial care & retirement facilities
*Museums & community centers

Title: SBA Disaster Assistance Program
Agency: US Small Business Administration

The SBA Disaster Assistance Program provides low-interest loans to businesses following a Presidential disaster declaration. The loans target businesses to repair or replace uninsured disaster damages to property owned by the business, including real estate, machinery and equipment, inventory and supplies. Businesses of any size are eligible, along with non-profit organizations.

SBA loans can be utilized by their recipients to incorporate mitigation techniques into the repair and restoration of their business.

Title: Community Development Block Grants Agency: US Department of Housing and Urban Development
The community Development Block Grant (CDBG) program provides grants to local governments for community and economic development projects that primarily benefit low- and moderate-income people. The CDBG program also provides grants fro post-disaster hazard mitigation and recovery following a Presidential disaster declaration. Funds can be used for activities such as acquisition, rehabilitation or reconstruction of damaged properties and facilities and for the redevelopment of disaster areas.

Local

Local governments depend upon local property taxes as their primary source of revenue. These taxes are typically used to finance services that must be available and delivered on a routine and regular basis to the general public. If local budgets allow, these funds are used to match Federal or State grant programs when required for large-scale projects.

Non-Governmental

Another potential source of revenue for implementing local mitigation projects are monetary contributions from non-governmental organizations, such as private sector companies, churches, charities, community relief funds, the Red Cross, hospitals, Land Trusts and other non-profit organizations.

CONTINUED PUBLIC INVOLVEMENT

During interim periods between the five year re-write, efforts will be continued to encourage and facilitate public involvement and input. The plan will be available for public view and comment at local libraries and city offices, the BRAG office, and on the internet (http://www.brag.dst.ut.us/develop-hazard%20mit.htm). Comments will always be received whether orally, written or by e-mail.

All ongoing workshops and trainings will be open to the public and appropriately noticed. Ongoing press releases and interviews will help disseminate information to the general public and encourage participation.

As implementation of the mitigation strategies continues in each local jurisdiction, the primary means of public involvement will be the jurisdiction's own public comment and hearing process. State law as it applies to municipalities and counties requires this as a minimum for many of the proposed implementation measures. Effort will be made to encourage cities, towns and counties to go beyond the minimum required to receive public input and engage stakeholders.

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APPENDIX A: LOCAL GOVERNMENT SURVEY SUMMARY

BRIGHAM CITY

20 North Main Brigham City, UT
435-734-2001
Survey completed by: Jim buchanan

Participation in NFIP?
Don't know

Existing or Potential Natural Hazards

Drought	Soil Subsidence
Landslide	Earthquake
Wildfire	Winds
Dam Failure	Severe Weather
Flooding	

Completed Natural Hazard Mitigation Projects.
None

Needed Natural Hazard Mitigation Projects?
A lot

Building Codes Used in Community?
Ibc 2000

Fire Insurance Rating
5

Natural Hazard Maps, Documents, Ordinances or Plans.
a lot not sure

Contact Person
Jim Buchanan
PH # 734-2001-2401
Email jbuchanan@favorites.com

Bear River City

Survey completed by: Carol Andreasen
PO Box 160 Bear River, UT 84301
435-279-9047

Participation in NFIP?
No

Existing or Potential Natural Hazards

Earthquake	Wildfire
Drought	

Completed Natural Hazard Mitigation Projects.
None

Needed Natural Hazard Mitigation Projects?
?

Building Codes Used in Community?
UBC

Fire Insurance Rating
?

Natural Hazard Maps, Documents, Ordinances, or Plans.

Earth Quake Training Manual and Materials.
Box Elder County Emergency Preparedness Plan for Hazardous Materials.

Contact Person
?

Box Elder County

Survey completed by: Denton H. Beecher
01 South Main Street, Brigham City, UT 84302
435-734-3386

Participation in NFIP?
Yes

Existing or Potential Natural Hazards

Drought	Earthquake
Flooding	Wildfire
Landslide	Dam Failure
Soil Subsidence	Winter Storms
High Winds	Insect infestation
Hail Storms	

Completed Natural Hazard Mitigation Projects.
None

Needed Natural Hazard Mitigation Projects?
Drought
Earthquake

Building Codes Used in Community?
UBC

Fire Insurance Rating
Unknown

Natural Hazard Maps, Documents,Ordinances, or Plans.
Poor Quality Earth quake maps
Cutler Dam maps

Contact Person
Denton Beecher
435-734-3386

Fielding Town

Survey completed by: Mayor Jim Garn
Box 104 Fielding, UT 84311
435-458-3374

Participation in NFIP?
Don't know

Existing or Potential Natural Hazards

Earthquake	Drought
Flooding	Soil Subsidence

Completed Natural Hazard Mitigation Projects.
None

Needed Natural Hazard Mitigation Projects?
Disaster Plan

Building Codes Used in Community?
Box Elder County Codes

Fire Insurance Rating
unknown

Natural Hazard Maps, Documents,Ordinances, or Plans.
None

Contact Person
Mayor Jim Garn
435-458-3374

Hyde Park City

Survey completed by: David M. Kooyman
113 East Center St. Hyde Park City, UT 84318
435-563-6507
Hydepark@xmission.com

Participation in NFIP?
Don't know

Existing or Potential Natural Hazards
Flooding
Earthquake

Completed Natural Hazard Mitigation Projects.

Water system improvements 1995, Hyde Park City placed
the new water tank away from earth quake fault lines.

Needed Natural Hazard Mitigation Projects?
Not aware of any mitigation needs

Building Codes Used in Community?
ICBO Uniform Building Code 1997
IFCI Uniform Fire Code 1997

Fire Insurance Rating
unknown

Natural Hazard Maps, Documents,Ordinances, or Plans.
Floodplain map provided by FEMA

Contact Person
Mayor David Kooyman
435-563-6507 City
435-563-3364Home

Hyrum City

Survey completed by: D. Brent Jensen
83 West Main Hyrum, UT 84319
435-245-6033

Existing or Potential Natural Hazards
Drought Flooding
Earthquake Dam Failure

Completed Natural Hazard Mitigation Projects.
None

Needed Natural Hazard Mitigation Projects?
Moveable joints in waterlines crossing Faults

Building Codes Used in Community?
Uniform

Fire Insurance Rating

ISO 5

Natural Hazard Maps, Documents, Ordinances, or Plans.
None

Contact Person
D. Brent Jensen
435-245-6033

Lewiston

Survey completed by: Mark Blair
PO Box 67 Lewiston, UT 84320
435-258-2141
bliardocm@aol.com

Participation in NFIP?
Yes

Existing or Potential Natural Hazards
Drought
Earthquake
Flooding
Power outage
Hazardous Material
Winter Conditions

Completed Natural Hazard Mitigation Projects.
Emergency Management Plan

Needed Natural Hazard Mitigation Projects?
Identifying Hazardous material

Building Codes Used in Community?
State Code and our Own

Fire Insurance Rating
?

Natural Hazard Maps, Documents, Ordinances, or Plans.
Emergency Management Plan, lists hazards

Contact Person
Mark Blair
435-258-2141

City Of Logan

Survey completed by: Scott Douglas
255 North Main Logan, UT 84321
435-716-9670
sdouglas@loganutah.org

Participation in NFIP?
Yes

Existing or Potential Natural Hazards
Drought
Earthquake
Flooding
Landslide
Wildfire
Dam Failure
Soil Subsidence
Winter Storms

Building Codes Used in Community?
IRC
IBC
2000 International Code

Fire Insurance Rating
3

Completed Natural Hazard Mitigation Projects.

Dredging of river by Country Manor
Replacement of rr tressles on 1700 South
Flood retention ponds up dry canyon
Wildfire trail along mountains on east side
Insulators on power lines along foothills
River gauge on BlackSmith Fork River
Snotel site up Logan Canyon
Crockett Dam Renovation
(Projects completed from 1997-2002)

Needed Natural Hazard Mitigation Projects?

First priority- Dredging of First, Second, and Thrid Dams
Second priority- Second power source to the valley
Third priority- More flood mitigation including canal work
Fourth priority- Upgrade water sources
Fifth priority- Zoning ordinances for flood and earthquake ares

Natural Hazard Maps, Documents, Ordinances, or Plans.

City Disaster Plan, each department has specific area plans
GIS mapping of all utilities
FEMA Flood plain maps and earthquake fault line maps

Contact Person

Scott Eli Douglas
435-716-9670

Newton Town

Survey completed by: Mayor Floyd Salisbury
PO Box 146 Newton, UT 84327
435-563-6976

Participation in NFIP?

No

Existing or Potential Natural Hazards

Drought Flooding
Dam Failure

Completed Natural Hazard Mitigation Projects.

Dam overflow project, Cost $5,000,000 completed 15 -20 years ago

Needed Natural Hazard Mitigation Projects?

?

Building Codes Used in Community?

Utah Uniform Building Code

Fire Insurance Rating

6

Natural Hazard Maps, Documents, Ordinances, or Plans.

Flood Plain Map

Contact Person

Reed Jenkins
435-563-5532

Paradise Town

Survey completed by: Lee Atwood
11 West 8900 South Paradise, UT 84328
435-245-6737

Participation in NFIP?
?

Existing or Potential Natural Hazards
Earthquake Wildfire
Flooding dams and canals
Drought

Completed Natural Hazard Mitigation Projects.
None

Needed Natural Hazard Mitigation Projects?
?

Building Codes Used in Community?
UBC Cache County Contract

Fire Insurance Rating
7

Natural Hazard Maps, Documents, Ordinances, or Plans.
Maps on Flood Plain

Contact Person
?

Perry City

Survey completed by: Judy W. Bylsma
3005 South 1200 West Perry, UT 84302
435-723-6461
perrycty@vii.com

Participation in NFIP?
Yes

Existing or Potential Natural Hazards
Earthquake Wildfire
Flooding Drought
Landslide

Completed Natural Hazard Mitigation Projects.
Large Culverts and flood control devices installed in 3 Perry Canyons to wetlands west of I-15 to mitigate spring run-off (Flood Waters)

Needed Natural Hazard Mitigation Projects?
Complete storm drain system to mitigate storm run-off and flooding

Building Codes Used in Community?
International Building Code

Fire Insurance Rating
5

Natural Hazard Maps, Documents, Ordinances, or Plans.
Foothill ordinance

Contact Person
Edward J. Skrobiszewski
435-723-6461

Town of Portage

Survey completed by: Mayor Keith Wadman
Po Box 4 Portage, UT 84331
435-866-2108

Participation in NFIP?
No

Existing or Potential Natural Hazards
Drought Earthquake
Flooding Wildfire

Completed Natural Hazard Mitigation Projects.
None

Needed Natural Hazard Mitigation Projects?
Wildfire
Flooding
Earthquake
Drought

Building Codes Used in Community?
Box Elder County Codes

Fire Insurance Rating
Standard

Natural Hazard Maps, Documents, Ordinances, or Plans.
None

Contact Person
Mayor Keith Wadman
435-866-2108 or 435-866-9110

Richmond City

Survey completed by: Kip Panter & Marlow Adkins
6 West Main Richmond, UT 84333
435-258-2092
richmondcity@pcu.net

Participation in NFIP?
Yes

Existing or Potential Natural Hazards
Earthquake Flooding
Wildfire Drought
Wind

Completed Natural Hazard Mitigation Projects.
None

Needed Natural Hazard Mitigation Projects?
None

Building Codes Used in Community?
State of Utah Code
Contract inspection with Cache County

Natural Hazard Maps, Documents, Ordinances, or Plans.
General Plan identifies areas impacted by major Earthquake faults and potential flooding areas. Soil types have also been identified.

Contact Person
L. Alan Higham
435-258-2009

River Heights City

Survey completed by: Debbie Rees
520 South 500 East River Heights, UT 84321
435-752-2646

Participation in NFIP?
Don't Know

Building Codes Used in Community?
?

Existing or Potential Natural Hazards
Drought Earthquake
Flooding

Fire Insurance Rating
N/A

Completed Natural Hazard Mitigation Projects.
None

Natural Hazard Maps, Documents, Ordinances, or Plans.
None

Needed Natural Hazard Mitigation Projects?
Unknown

Contact Person
Deebie Rees
435-753-9073

Snowville Town

PO Box 734 Snowville, UT 84336
435-872-8501

Participation in NFIP?
No

Building Codes Used in Community?
Commercial
Residential

Existing or Potential Natural Hazards
Drought Earthquake
Flooding Wildfire

Fire Insurance Rating
?

Completed Natural Hazard Mitigation Projects.
None

Natural Hazard Maps, Documents, Ordinances, or Plans.
None

Needed Natural Hazard Mitigation Projects?
Drought
Earthquake

Contact Person
Gary Frandsen
435-872-8274

Tremonton City

Survey completed by: S. Warren Hodges, Rich Woodworth, and Steve Bench
102 South Tremonton, UT 84337
435-257-3131
police@tremontoncity.com

Participation in NFIP?
No

Existing or Potential Natural Hazards
Earthquake
Drought
Winter Storms
Flooding
Landslide
Dam Failure (impact utilities)
Soil Subsidence
Tornado
Wind Damage (non-cyclonic)

Completed Natural Hazard Mitigation Projects.
Natural Hazards addressed by uniform codes i.e., earthquake, snow load, structural considerations, and material suitability

Needed Natural Hazard Mitigation Projects?
?

Building Codes Used in Community?
2000 International Codes

Fire Insurance Rating
6

Natural Hazard Maps, Documents, Ordinances, or Plans.
Hillside development
Sensitive Area (SA) Malad River
Development Ordinances
Land Excavation- Special Requirements
Soils

Contact Person
S. Warren Hodges
435-257-3131
Blair Westgard, Fire Chief
435-230-0775

Willard City

Survey completed by: Leland Jacobson
PO Box 593 Willard, UT 84340
435-734-9881
willard@xmission.com

Participation in NFIP?
Yes

Existing or Potential Natural Hazards
Drought
Earthquake
Flooding
Landslide
Wetlands
Soil Subsidence

Completed Natural Hazard Mitigation Projects.
Flood mitigation on alluvial fan- ongoing
Debris Basin- Major effort about 1939

Needed Natural Hazard Mitigation Projects?
Continued work on flood control projects
Storm drainage needed

Building Codes Used in Community?
2000 International Codes

Fire Insurance Rating
?

Natural Hazard Maps, Documents, Ordinances, or Plans.
Sensitive Area Ordinance 12-200/ part of Zoning Ordinance

Contact Person
Lynne Buland
435-734-9209

APPENDIX B: U.S. ARMY CORPS OF ENGINEERS: FLOOD HAZARD IDENTIFICATION STUDY FOR THE BEAR RIVER DISTRICT

Flood Hazard Identification Study

Bear River Association of Governments

By:
United States Army Corps of Engineers
Utah Division of Emergency Services and Homeland Security

August 20, 2003

Introduction

The US Army Corps of Engineers Sacramento District completed this flood hazard identification study through a contract with the seven Associations of Governments. Funding was provided under the USACE Planning Assistance to States Program (Section 22). The intent of the study is to aid in detailing natural hazards associated with fluvial process for entities within each AOG currently unmapped as part of the National Flood Insurance Program or mapped as D zone areas.

Acknowledgements

The following agencies aided in preparation, interpretation, and completion of this flood hazard investigation study.

Utah Associations of Governments
Bear River Association of Governments
Sacramento District Corps of Engineers
Utah Division of Emergency Services and Homeland Security

Scope of Work

This study will evaluate and identify areas with a high flood hazard and identify potential mitigation solutions. The areas evaluated in this study include the three unincorporated counties of Box Elder, Cache, and Rich. Municipalities within the three counties were studied if they met the following criteria:

1. Jurisdiction has not been mapped by FEMA,
2. Jurisdiction mapped by FEMA as a Zone D, area of undetermined flood hazard.

Fluvial hazards within the cities and towns of: Bear River, Deweyville, Elwood, Fielding, Garland, Howell, Plymouth, Portage, Snowville, and Tremonton were studied.

Description of the Study Area

This study includes the northern most counties of Utah, Box Elder, Cache, and Rich counties. The three counties are contained within two major physiographic provinces the Basin and Range province with comprises the majority of western Box Elder County, and the Middle Rocky Mountain Province. Vegetation corresponds with moisture, which increases with elevation. Thus, valleys and low land areas have desert brushes and grasses, which turn to pinyon-juniper and coniferous forests as elevation increases.

Population in the Bear River Association is predominately aligned along mountain fronts near interstates, with the majority of western Box Elder County sparsely populated. The agricultural sector still plays a large part in the economy of the study area, as does Utah State University located in Logan.

With the exception of the Raft River Mountains (tributary to the Snake River), the entire study area is drained by the Bear River, into the Great Salt Lake, a remnant of ancient Lake Bonneville. Major tributaries of the Bear River include: Malad River, Sheep Creek, Saleratus Creek, The little Bear, and Blacks Fork. Outside of the 1983 flooding event damage due to flooding in the study area has been quite limited, primarily damaging crops and agricultural infrastructure.

Discussion, Data, and Observations

Data presented in this study are from the following sources:

Box Elder County Emergency Operations Plan
Cache County Emergency Operations Plan
Rich County Emergency Operations Plan
Bear River Basin: Planning for the Future December 2002
US Army Corps of Engineers Wasatch Front and Central Utah Study July 1984 Volumes I and II
US Army Corps of Engineers Reconnaissance Report Bear River Basin Investigation February 1989

In addition to incorporating existing studies and plans completed in the area, this flood hazard study also contains information from technical experts familiar with the study area. The mitigation projects are purely suggested actions, which based on past experience, will reduce or eliminate the identified fluvial hazard. These mitigation recommendations in no way represent the only measure to attain fluvial mitigation. In many cases the proposed or best solution is simply avoidance. This method of mitigation is implemented through the use of zoning, and represents in most cases the lowest cost mitigation measure.

Need For Additional Research
Additional research should be conducted resulting in better maps for communities currently mapped as a FEMA Zone D, unmapped communities, and communities with outdated Flood Insurance Rate Maps. Communities would benefit from knowing peak flows and stages on tributaries of concern.

Disclaimer
The information provided in this study was developed from a number of sources including:
Past USACE studies done within the region and drainage basins,
Personal knowledge,
Limited onsite visits,
Map interpolations,
Current GIS work.

Even though care was taken to ensure a measure of correctness and field checks were preformed on the information and data gathered, it is important to note this flood hazard study is presented “as is”. The United States Army Corps of Engineers, Division of Emergency Service and Homeland Security, or any other agency assisting in completion of this study cannot accept any responsibilities for errors, omissions, or accuracy. There are no warranties, which accompany this product. Users are cautioned to field verify information provided in this product before making any decisions. In no way does the mapping presented in this study take the place of a regulatory FEMA Flood Insurance Rate Map (FIRM), or replace any flood hazard identification product developed by FEMA / National Flood Insurance Program (NFIP).

How Communities Where Ranked
The communities within this study were ranked based on a committee’s evaluation. The evaluation committee consisted of the:
Utah State Floodplain Program Manager
Utah State Hazard Mitigation Officer,

Natural Hazard Mitigation Planner,
U.S. Army Corps of Engineers,
State Earthquake Program Manager.

This committee researched each of the twenty-nine counties and all 269 incorporated areas within the State of Utah. Each jurisdiction was assigned one of five ratings: Very High, High, Moderate, Low, or Not Rated. These ratings in no way reflect actual flood threat. The ratings were assigned based on the following variables:
Perceived flood threat based on topography, past flooding occurrences, and experience of committee members.
Participation in the National Flood Insurance Program (NFIP).
Past studies included, but not limited to, regulatory FEMA/NFIP Flood Insurance Studies (FIS), other flood studies, and reconnaissance reports.
Population growth within the jurisdiction.
If the community is mapped by FEMA/National Flood Insurance Program NFIP), and type of map which identifies high, moderate and low flood threats

Ratings were used to set the scope of work for each community within this study. **Information on excluded communities was added were available.**

A Word about Wildfires
Almost every year several communities around the state are flooded and/or affected by post burn debris flows. Wildfire damaged watersheds have conditions which increase the potential for debris flows which may damage structures and infrastructure in the impacted area. Overall, the heightened risk associated with alluvial fans is always of concern. Post fire revegetation and stabilization efforts in many cases do not alleviate the threat due to flooding and debris flow.

A Word About Dams
Dams are a critical support function for water managers in the State and can also act as a flood control measure. If a dam remains stable, does not get overtopped, or is not impaired as the result of an earthquake, then, at a minimum, they do provide incidental flood control. If not then they can add to the flood threat. There are 67 dams within Bear River AOG of those 12 have received a high hazard rating by Utah Division of Water Rights Dam Safety section. The State Dam Safety Section has developed a hazard rating system for all non-federal dams in Utah. Downstream uses, size, height, volume, and incremental risk/damage assessments are a variable used to assign dam safety classification. Using the hazard ratings systems developed by the State Dam Safety Section, dams are placed into one of three classifications high, moderate, and low. Dams receiving a low rating would have insignificant property loss do to dam failure. Moderate hazard dams would cause significant property loss in the event of a breach. High hazard dams would cause a possible loss of life in the event of a rupture. The frequency of dam inspection is designated based on hazard rating with the Division of Water Rights inspecting high-hazard dams annually, moderate hazard dams biannually, and low-hazard dams every five years.

Box Elder County
Blue Creek
Mutton Hollow Debris Basin

Three Mile Creek Debris Basin
Cutler
Mantua
Cache County
Tony Grove Lake Dam
Hyrum
Logan First Dam
Porcupine
Newton
Rich County
Birch Creek No. 2
Woodruff Creek

Bear Lake a prominent recreation area is near the mid-point of the Bear River. Historically, the Bear River did not naturally flow into Bear Lake. In 1902 a predecessor of Utah Power and Light constructed inlet and outlet canals in an effort to divert Bear River Water into the lake for later release during the agricultural growing season. River modifications have created an active storage capacity of 1,452,000 acre-feet in Bear Lake and the ability to control the flow of the river.

Box Elder County

COUNTY	CITY/TOWN	POPULATION	STATE MAP LOCATION	NFIP STATUS	THREAT (or NSFHA-eligible)
Box Elder	Unincorporated	8023		490005 - 9/1/87(L)	Bear River and Tributaries
Box Elder	Bear River City	750	B4	Not Participating	Bear River and Tributaries
Box Elder	Brigham City	17411	B4	490006 - 8/17/81	
Box Elder	Corrine	621	B4	490197 - 7/15/80(M)	
Box Elder	Deweyville	278	B4	Not Participating	Bear River and Tributaries
Box Elder	Elwood	678	B4	**Not Participating**	Bear River and Tributaries
Box Elder	Fielding	448	B4	**Not Participating**	Bear River and Tributaries
Box Elder	**Garland**	1943	B4	**Not Participating**	Bear River and Tributaries
Box Elder	Honeyville	1214	B4	490008 - 7/29/80(M)	
Box Elder	Howell	221	B4	Not Participating	NSFHA-Eligible
Box Elder	Mantua	791	C4	490009 - 7/8/80(M)	
Box Elder	Perry	2383	C4	490010 - 5/20/80(M)	
Box Elder	Plymouth	328	C4	Not Participating	Bear River and Tributaries
Box Elder	**Portage**	257	B4	**Not Participating**	Bear River and Tributaries
Box Elder	**Snowville**	177	B3	**Not Participating**	Deep Creek Tributaries
Box Elder	**Tremonton**	5592	B4	**Not Participating**	Bear River and Tributaries
Box Elder	Willard	1630	C4	490011A - 7/1/87(L)	

* D = Detailed Study Report and Map Prepared.

Box Elder County Flood and Dam failure History

Hazards	Date	Location	Critical Facility or Area Impacted	Comments
Flood	August 6, 1947	Brigham City	Limited damage	

Box Elder		Willard	to fruit orchards and US 91	
Flood Box Elder	May 17, 1949	Perry	50 farms damaged, several thousand dollars in damage to farms, orchards, and roads.	Source Mt. Baldy area
Flood Box Elder	August 10, 1952	Willard	$100,000 in damage to orchards due to hail, US 91 covered with mud	
Flood Box Elder	June 14, 1960	Brigham City	Crop damage	Heavy rains large hail.
Flood Box Elder	August 8, 1968	Howell	Flooding and damage to farmland	Source Blue Creek
Flood Box Elder	June 24, 1969	Brigham City	Business establishments flooded on Main Street.	
Flood Box Elder	Spring 1983	Brigham City,	Basement damage, foundation walls, and homes. Waste treatment plant in Box Elder Creek threatened.	Total PA requests of $146,596 for Box Elder County. Ground water and many slides.
		Garland	Dike along river eroded and floodwaters damaged community water supply pump house.	Source Bear River
		Honeyville	High ground water causing flooding	
		Willard	Several homes were inundated	Source Willard and Facer Creeks.
Flood Box Elder	Spring 1984	Entire County	Overland flows carried debris onto private	Damage total $331,442.00

			lands, and filled Willard, Facer, and Barker Debris Basins. Flows eroded pavement, washed out road shoulders, and culverts.	

(All dollar values given are for year of disaster)

Unincorporated Box Elder County

Box Elder County Flood Mitigation Goals -
Goal 1 Reduce Risk of Potential Flooding

Unincorporated Box Elder County – Problem Identification: This county has just under 20 percent of its residents living in the unincorporated county – many in the areas surrounding Brigham City and Tremonton. Box Elder also appears to be the county with the smallest percentage of communities participating in the NFIP – most likely because the flood threats are, for the most part, only minor to moderate - several being NSFHA-Eligible. The Bear and Malad Rivers and their tributaries represent the major flood threats to development.

Objective: Minimize future flood damage in the unincorporated County

Action: Nonstructural measures appear to be the most prudent option for the county to implement in the unincorporated areas. Zoning to prevent development of structures near all rivers, creeks, and lakes would be prudent
(100 ft minimum setback; greater adjacent to the Bear River) as well as not allowing development on alluvial fans. New development near canals should also be discouraged, as there have been several potentially deadly flood events in the state due to flooding caused by canal failures. The cost of modifying county laws to include these is minimal and the benefits substantial (although there will be a small percentage of the population that will oppose any zoning or other changes in the laws for that matter).

Timeframe:
Funding:
Estimated Cost: Minimal.
Staff:

Bear River City – Problem Identification: This community does not participate in the NFIP. As its name implies, the Bear River runs through it – posing a significant flood threat. A tributary to the Malad River also runs along the west side of the community.

Objective: Minimize future flood damage in Bear River City.

Alternative Action: Given the relatively few number of existing structures, flood proofing may be a viable alternative – especially for those structures with a history of being flooded.

Timeframe:
Funding:
Estimated Cost: $10k - $30k for the average home to flood proof.
Staff:

Alternative Action: An alternate project could consist of zoning of the flood prone area to insure that all new developments are sited as far away from the channels as possible (or at least constructed so as to be higher in elevation than the flood threat). This however, would do nothing to protect existing development.

Timeframe:
Funding:
Estimated Cost: minimal.
Staff:

Deweyville – Problem Identification: This small community does not participate in the NFIP. It is at risk from flooding of not only the Bear River (the bank is apparently the town boundary) but also from not less than half dozen east side drainages. Most of the community appears to be at risk but the developed areas appear to be most threatened by the east side drainages as there is apparently little development near the Bear River.

Objective: Minimize future flood damage in Deweyville.

Alternative Action: Given the relatively few number of existing structures, flood proofing may be a viable alternative – especially for those structures with a history of being flooded.

Timeframe:
Funding:
Estimated Cost: $10k - $30k for the average home to flood proof.
Staff:

Alternative Action: An alternate project could consist of zoning of the flood prone area to insure that all new developments are sited as far away from the channels as possible (or at least constructed so as to be higher in elevation than the flood threat). This however, would do nothing to protect existing development.

Timeframe:
Funding:
Estimated Cost: minimal.
Staff:

Elwood – Problem Identification: This community does not participate in the NFIP. As with Bear River City, it faces a significant threat from the Bear River on the east and the Malad River on the west. Much of the original development appears to be sited along Highway 191, approximately the same distance away from the two rivers making relatively safe from the flood threat of either. New development; however, has come increasingly closer to both rivers, increasing the overall flood threat.

Objective: Minimize future flood damage in Elwood.

Alternative Action: Given the relatively few number of existing structures at risk, flood proofing may be a viable alternative – especially for those structures with a history of being flooded.

Timeframe:
Funding:
Estimated Cost: $10k - $30k for the average home to flood proof.
Staff:

Alternative Action: An alternate project could consist of zoning of the flood prone area to insure that all new developments are sited as far away from the channels as possible (or at least constructed so as to be higher in elevation than the flood threat). This however, would do nothing to protect existing development.

Timeframe:
Funding:
Estimated Cost: minimal.
Staff:

Fielding – Problem Identification: Northeast of Garland, this community does not participate in the NFIP. However, it appears that it is far enough away and high enough above the Bear and Malad Rivers to be NSFHA-Eligible.

Objective: Minimize future flood damage in Fielding.

Action: Identify Fielding as a NSFHA-eligible community (pending evaluation of flood history and evidence of past flooding).

Timeframe:
Funding:
Estimated Cost: Minimal
Staff:

Garland – Problem Identification: Just north of Tremonton, Garland does not participate in the NFIP. As there are apparently no rivers, creeks, or streams running through the town, it appears to have little flood threat and would be NSFHA-Eligible.

Objective: Minimize future flood damage in Garland.

Action: Identify Garland as a NSFHA-eligible community (pending evaluation of flood history and evidence of past flooding).

Timeframe:
Funding:
Estimated Cost: Minimal
Staff:

Howell – Problem Identification: This small community does not participate in the NFIP. It does not appear to have a significant flood threat due in large measure to the upstream Blue Creek Reservoir. Therefore, Howell appears to be a NSFHA-Eligible community.

Objective: Minimize future flood damage in Howell.

Action: Identify Howell as a NSFHA-eligible community (pending evaluation of flood history and evidence of past flooding).

Timeframe:
Funding:
Estimated Cost: Minimal
Staff:

Plymouth – Problem Identification: This community does not participate in the NFIP. Most of the town appears vulnerable to flooding from the 2 rather large drainages to the northeast whose creeks pass through town.

Objective: Minimize future flood damage in Plymouth.

Alternative Action: One project that would reduce the existing flood threat would be an overflow channel along the east-west road (about ½ mile north of town) from Bishop Canyon, picking up the other two drainages, then under Highway 191 to the drainage adjacent to the city cemetery (which drains to the Bear River).

Timeframe:
Funding:
Estimated Cost: About $200k for excavation and culverts (assuming the road itself (and the culverts through it) do not need modification.
Staff:

Alternative Action: An alternate project could consist of zoning of the flood prone area to insure that all new developments are sited as far away from the channels as possible (or at least constructed so as to be higher in elevation than the flood threat). This however, would do nothing to protect existing development.

Timeframe:
Funding:
Estimated Cost: minimal.
Staff:

Portage – Problem Identification: This community does not participate in the NFIP. It is primarily threatened from 2 creeks to the west – Portage Canyon and an unnamed drainage to the north. The main Portage Canyon channel appears to skirt the town to the southwest while the unnamed drainage does a very similar thing on the northwest. The residual threat to developments in Portage appears to be very minimal.

Objective: Minimize future flood damage in Portage.

Action: Since the flood threat for this community is so minor, A potential project could consist of zoning of the flood prone areas to insure that all new developments are sited as

far away from the channels as possible (or at least constructed so as to be higher in elevation than the flood threat). This however, would do nothing to protect existing development.

Timeframe:

Funding:

Estimated Cost: minimal.

Staff:

Snowville – Problem Identification: This the smallest incorporated community in the county with under 200 residents. It does not participate in the NFIP. There appears to be a substantial threat to most all the community from several relatively large Deep Creek tributary drainages to the east. (Rose Ranch Reservoir is downstream of the community so it cannot provide flood protection.)

Objective: Minimize future flood damage in Snowville.

Alternative Action: Given the relatively few number of existing structures at risk, flood proofing may be a viable alternative – especially for those structures with a history of being flooded.

Timeframe:

Funding:

Estimated Cost: $10k - $30k for the average home to flood proof.

Staff:

Alternative Action: An alternate project could consist of zoning of the flood prone area to insure that all new developments are sited as far away from the channels as possible (or at least constructed so as to be higher in elevation than the flood threat). This however, would do nothing to protect existing development.

Timeframe:

Funding:

Estimated Cost: minimal.

Staff:

Tremonton – Problem Identification: Although Tremonton is the second largest community in Box Elder County; it does not participate in the NFIP. There is; however, a significant flood threat from the Malad River that flows right through the east side of town. The limited detail floodplains identified on the adjacent county map reflect what should be considered a minimal flood hazard area. In all likelihood, actual flooding would be much greater than that shown on the limited detail map. Original development in Tremonton seems to be sited a reasonable distance away from the river. It appears however, that newer development is encroaching into the floodplain.

Objective: Minimize future flood damage in Tremonton.

Alternative Action: Given the relatively few number of existing structures at risk, flood proofing may be a viable alternative – especially for those structures with a history of being flooded.

Timeframe:

Funding:

Estimated Cost: $10k - $30k for the average home to flood proof.
Staff:

Alternative Action: An alternate project could consist of zoning of the flood prone area to insure that all new developments are sited as far away from the channels as possible (or at least constructed so as to be higher in elevation than the flood threat). This however, would do nothing to protect existing development.
Timeframe:
Funding:
Estimated Cost: minimal.
Staff:

Cache County

COUNTY	CITY/TOWN	POPULATION	STATE MAP LOCATION	NFIP STATUS	THREAT (or NSFHA-eligible)
Cache	Unincorporated	5766		490012 - 2/1/87(L)	Bear River and Tributaries
Cache	Amalga	427	B4	490013 - NITP	
Cache	Clarkston	688	B4	490014 - 8/19/80(M)	
Cache	Cornish	259	B4	Not Participating	Bear River and Tributaries
Cache	Hyde Park	2955	B5	490016 - 7/29/80(M)	
Cache	Hyrum	6316	B5	490017 - 4/8/80(M)	
Cache	Lewiston	1877	B5	490018 - 7/29/80(M)	
Cache	Logan	42670	B5	490019 - 9/28/84	
Cache	Mendon	898	B4	490020 - 7/22/80(M)	
Cache	Millville	1507	B5	490021 - 10/22/76	
Cache	Newton	699	B4	490022 - 7/22/80(M)	
Cache	Nibley	2045	B5	490023A - NITP	
Cache	North Logan	6163	B5	490024 - 3/18/86(M)	
Cache	Paradise	759	B5	490025 - NITP	
Cache	Providence	4377	B5	490226 - (NSFHA)	
Cache	Richmond	2051	B5	4900027 - 8/12/80(M)	
Cache	River Heights	1496	B5	Not Participating	**NSFHA-eligible**
Cache	Smithfield	7261	B5	490029 - 3/18/86(M)	
Cache	**Trenton**	449	B4	Not Participating	Bear River & Ransom Hollow
Cache	Wellsville	2728	B4	490031 - 7/29/80(M)	

* D = Detailed Study Report and Map Prepared.

Cache County Flood and Dam failure History

Hazards	Date	Location	Critical Facility or Area Impacted	Comments
Flood Cache	May 30, 1958	Logan	Damage to crops due to hail and high winds. Water caused road damage	
Flood Cache	August 22, 1958	Clarkston	Limited damage to homes. Highways and roads covered with water	
Flood Cache	August 18, 1959	Providence	Dozens of homes damaged. Flooding caused rock and mudslides in Logan Canyon	
Flood Cache	June 6, 1964	Smithfield	Intense storm flooded a number of homes within town.	Source Summit Creek

(All dollar values given are for year of disaster)

Unincorporated Cache County

Cache County Flood Mitigation Goals -
Goal 1 Reduce Risk of Potential Flooding

Unincorporated Cache County – Problem Identification: Only 6 percent of the county's population is in the unincorporated county, primarily in the Cache Valley surrounding Logan. Clearly, the major flood threat is to those properties adjacent to the Bear River and its tributaries. Reservoirs include Hyrum and Newton.

Objective: Minimize future flood damage in the unincorporated County.

Action: Nonstructural measures appear to be the most prudent option for the county to implement in the unincorporated areas. Zoning to prevent development of structures near all rivers, creeks, and lakes would be prudent
(100 ft minimum setback; greater adjacent to the Bear River) as well as not allowing development on alluvial fans. New development near canals should also be discouraged,

as there have been several potentially deadly flood events in the state due to flooding caused by canal failures. The cost of modifying county laws to include these is minimal and the benefits substantial (although there will be a small percentage of the population that will oppose any zoning or other changes in the laws for that matter).

Timeframe:
Funding:
Estimated Cost: Minimal.
Staff:

Cornish – Problem Identification: Cornish lies in northwest Cache County just south of the Idaho border. It is the smallest community in Cache County and does not participate in the NFIP. It appears that there is a moderate flood threat to the low-lying areas on the east side of town adjacent to the Bear River. There is a lesser threat from the drainages coming out of the hills west of town, which are blocked by the north-south West Cache Canal.

Objective: Minimize future flood damage in Cornish.

Alternative Action: Given the relatively few number of existing structures at risk, flood proofing may be a viable alternative – especially for those structures with a history of being flooded.

Timeframe:
Funding:
Estimated Cost: $10k - $30k for the average home to flood proof.
Staff:

Alternative Action: An alternate project could consist of zoning of the flood prone area to insure that all new developments are sited as far away from the channels as possible (or at least constructed so as to be higher in elevation than the flood threat). This however, would do nothing to protect existing development.

Timeframe:
Funding:
Estimated Cost: Minimal.
Staff:

River Heights – Problem Identification: This community, just south of Logan, does not participate in the NFIP. It appears that although the northern boundary is adjacent to the Logan River, the community is on a bluff overlooking the river. The only potential threats are from Dry Canyon to the northeast and from the unnamed drainages east of town. (The City of Logan has constructed a detention basin on Dry Canyon - east of River Heights). Based on the topographic map, it appears that the unnamed drainages some distance east of town, would tend to flow southwest toward the Spring Creek drainage south of River Heights proper. Based on the incorporated boundary on the county NFIP map, River Heights appears to be a NSFHA-Eligible community.

Objective: Minimize future flood damage in River Heights.

Action: Identify River Heights as a NSFHA-eligible community (pending evaluation of flood history and evidence of past flooding).

Timeframe:
Funding:
Estimated Cost: Minimal
Staff:

Trenton – Problem Identification: This community does not participate in the NFIP. It appears vulnerable to flooding on the east side of town from the Bear River and to a lesser extent from Ransom Hollow Creek through town (because it is a hollow).

Objective: Minimize future flood damage in Trenton.

Alternative Action: Given the relatively few number of existing structures at risk, flood proofing may be a viable alternative – especially for those structures with a history of being flooded.

Timeframe:
Funding:
Estimated Cost: $10k - $30k for the average home to flood proof.
Staff:

Alternative Action: An alternate project could consist of zoning of the flood prone area to insure that all new developments are sited as far away from the channels as possible (or at least constructed so as to be higher in elevation than the flood threat). This however, would do nothing to protect existing development.

Timeframe:
Funding:
Estimated Cost: minimal.
Staff:

Rich County

COUNTY	CITY/TOWN	POPULATION	STATE MAP LOCATION	NFIP STATUS	THREAT (or NSFHA-eligible)
Rich	Unincorporated	739		Not Participating	
Rich	Garden City	357	B5	**Not Participating**	
Rich	Laketown	188	B5	490099 - (NSFHA)	
Rich	Randolph	483	B6	**Not Participating**	
Rich	Woodruff	194	C6	490101 - 7/22/80(M)	

Rich County Flood and Dam failure History

Hazards	Date	Location	Critical Facility or Area Impacted	Comments
Flood Rich Presidential	Spring 1983	Randolph and Woodruff	Damage to roads, culverts bridges, basements, and farmlands.	Source Bear Lake, Dean Ditch, and Woodruff Creek, PA cost $37,161

(All dollar values given are for year of disaster)

Unincorporated Rich County

Rich County Flood Mitigation Goals -
Goal 1 Reduce Risk of Potential Flooding

Unincorporated Rich County – Problem Identification: As one of the smallest counties in terms of population, Rich County does not participate in the NFIP. Although over 1/3 of the county's population is in the unincorporated county, primarily in the areas adjacent to Garden City and Laketown on Bear Lake. Clearly, the major flood threat in the unincorporated county is to those properties adjacent to the Bear River and Bear Lake. Less significant threats also exist along Woodruff and other smaller creeks throughout the county. Bear Lake is by far the largest water body in the county.

Objective: Minimize future flood damage in the unincorporated County.

Action: Nonstructural measures appear to be the most prudent option for the county to implement in the unincorporated areas. Zoning to prevent development of structures near all rivers, creeks, and lakes would be prudent
(100 ft minimum setback; greater adjacent to the Bear River) as well as not allowing development on alluvial fans. New development near canals should also be discouraged,

as there have been several potentially deadly flood events in the state due to flooding caused by canal failures. The cost of modifying county laws to include these is minimal and the benefits substantial (although there will be a small percentage of the population that will oppose any zoning or other changes in the laws for that matter).

Timeframe:
Funding:
Estimated Cost: Minimal.
Staff:

Garden City – Problem Identification: This community does not participate in the NFIP. The major flood threat to this community is from Garden City Canyon and to a lesser extent, the drainages to the south and north.

Objective: Minimize future flood damage in Garden City.

Alternative Action: A structural mitigation project for this community could be a deflector levee on the west side of town near the city limit – a distance of about 8,000 ft.
Timeframe:
Funding:
Estimated Cost: The preliminary cost for the levee project would be about $400,000.
Staff:

Alternative Action: An alternate project could consist of zoning of the flood prone area to insure that all new developments are sited as far away from the channels as possible (or at least constructed so as to be higher in elevation than the flood threat). This however, would do nothing to protect existing development.
Timeframe:
Funding:
Estimated Cost: minimal.
Staff:

Randolph – Problem Identification: The largest community in Rich County, it does not participate in the NFIP. The main flood threat appears to be from Little Creek and adjacent drainages to the west. Based on the topographic map, there is a reservoir about 2 miles west of Randolph on Little Creek that could provide some incidental flood protection.

Objective: Minimize future flood damage in Randolph.

Alternative Action: A structural mitigation project for this community could be an overflow channel on the north side of town near the city limit – a distance of about a mile.
Timeframe:
Funding:
Estimated Cost: The preliminary cost for the levee project would be about $250k to $500k depending on the channel and culvert sizes.
Staff:

Alternative Action: An alternate project could consist of zoning of the flood prone area to insure that all new developments are sited as far away from the channels as possible (or at least constructed so as to be higher in elevation than the flood threat). This however, would do nothing to protect existing development.

Timeframe:

Funding:

Estimated Cost: minimal.

Staff:

APPENDIX C: COORDINATION, COLLABORATION AND PUBLIC INPUT

Natural Hazard Mitigation Planning

Bear River District Fact Sheet

What is Hazard Mitigation?

"Hazard Mitigation" means to permanently reduce or alleviate the losses of life, injuries and property resulting from natural and human-made hazards through long-term strategies. These long-term strategies include planning, policy changes, programs, projects and other activities. Mitigation is the responsibility of individuals, private businesses and industries, state, local and federal governments.

What is the Disaster Mitigation Act of 2000?

These new regulations administered by the Federal Emergency Management Agency (FEMA), require that each county, city or town have an approved Natural Hazard Mitigation Plan in order to be eligible for post-disaster financial assistance in the event of a presidential disaster declaration as well as other ongoing FEMA hazard mitigation grants.

What is Required of My Community?

Counties, cities and towns are not mandated according to this new Federal Law to have approved mitigation plans; the program is voluntary. Congress indicates, however, that communities which do not have FEMA-approved mitigation plans will not qualify for certain kinds of federal disaster assistance.

The State of Utah's Department of Public Safety, Division of Comprehensive Emergency Management has chosen to utilize a regional planning approach to accomplish local mitigation planning goals in Utah. BRAG will complete the regional plan that will include consideration of all of the participating counties, cities and towns. FEMA will accept "regional mitigation plans as local plans, provided the counties, cities and towns provide input to the planning process and sign-off on the plans." Specifically, your participation will consist of passing a resolution of participation, appointing a local contact to represent your interests and provide information, and finally, adopt the plan before November 1, 2003.

What Are the Benefits For My Community?

- Insuring your community has full access to post-disaster federal funding.
- Potentially reduce the loss of life, property, essential services, critical facilities and economic hardship.
- Potentially reduce short-term and long-term recovery and reconstruction costs.
- Increase cooperation and communication within the community through the planning process.
- BRAG will take the lead, and with your cooperation, essentially complete the plan for you.

FOR MOR INFORMATION CONTACT JEFF GILBERT (435) 752-7242 jeffg@brag.dst.ut.us

B R A G
Bear River Association of Governments

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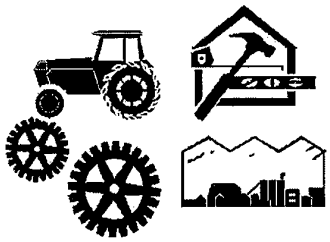
Logan, Utah 84321
(435) 752-7242

Natural Hazard Mitigation Planning

~ COMMUNITY AND ECONOMIC DEVELOPMENT ~



CDBG
Agricultural Preservation
Bear River Heritage Area
Planning Assistance
Bonneville Shoreline Trail
Business Services/Financing
Demographics

Natural Hazard Mitigation Planning Overview

Draft Bear River District Pre-disaster Mitigation Plan

Related Links:

Hazard Mitigation Plan-State of Utah

Hazard Planning Guidebook

FEMA DMA 2000 Resources

Strategies to mitigate impacts of Natural Hazards

For Information regarding this web site, contact webmaster@brag.dst.ut.us

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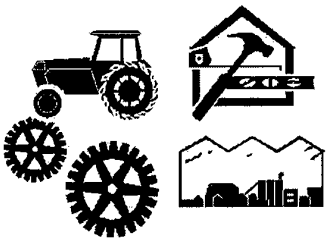
Draft Bear River Pre-Disaster Mitigation Plan

~ COMMUNITY AND ECONOMIC DEVELOPMENT ~



CDBG
Agricultural Preservation
Bear River Heritage Area
Planning Assistance
Bonneville Shoreline Trail
Business Services/Financing
Demographics

E-mail your comments, concerns & questions
jeffg@brag.dst.us

Part I Plan Pre-requisites

Part II Planning Process

Part III General Regional Data

Part IV Risk Assessment

Hazard Identification & Definitions

Region Annex -Agricultural Related Hazards

Box Elder County Annex-Flood, Wildfire, Landslide, Earthquake & Dam failure

Box Elder County Hazard Maps: Population density, ownership, critical facilities, flood, wildfire, landslide, liquefaction, faults

Cache County Annex-Flood, Wildfire, Landslide, Earthquake & Dam failure

Cache County Hazard Maps: Population density, ownership, critical facilities, flood, wildfire, landslide, liquefaction, faults

Rich County Annex-Flood, Wildfire, Landslide, Earthq & Dam failure

Rich County Hazard Maps: Population density, ownership, critical facilities, wildfire, faults

Part V Capability Assessment

Part VI Plan Maintenance

For Information regarding this web site, contact webmaster@brag.dst.ut.us

Prevention top priority in BRAG disaster plan

By Joe Rowley
staff writer

How much does it cost to clean up after a flood, earthquake or mud slide? Apparently, way too much.

The Bear River Association of Governments, or BRAG, along with regional and local groups across the nation, is working on a plan that should slow the rapidly rising costs of natural disaster relief. It comes from a federal initiative that finally makes sense, BRAG Community Development Director Jeff Gilbert said.

Over the past 20 years, the costs of cleaning up and rebuilding after natural disasters has been increasing significantly, BRAG Executive Director Roger Jones said. The federal government and private insurance companies have been footing increasingly higher bills, and the government finally decided to do something about it, he said.

> "It's common sense stuff that hasn't received a concerted effort nationwide."
>
> **– Roger Jones**
> **BRAG executive director**

To fix the problem, the Federal Emergency Management Agency, or FEMA, and Congress passed new regulations in 2000 that require cities to put more effort into planning with a focus on avoiding natural disasters. For example, rather than paying for the cleanup after a weak bridge gets washed out from a flood, communities ought to go to the lesser expense of identifying and fixing the problem bridge ahead of time, Jones said.

"It's common sense stuff that hasn't received a concerted effort nationwide," Jones said.

Some local officials already know about many of the possible hazards that could befall Cache County residents, Gilbert said. Logan and other cities have put into place emergency response plans, which by definition anticipate potential situations.

"We're really quite geared up for emergency response," Gilbert said.

The hazard mitigation plan takes it further than that, though.

The federal initiative applies to communities nationwide. To make it easier on communities in Utah, state officials decided to allow regional associations to develop one plan that would incorporate the needs of all their individual cities. BRAG started working in November on a plan that would apply to 39 cities in Cache, Rich and Box Elder counties, Gilbert said.

Once the plan is completed, each city merely has to adopt an ordinance accepting the plan to comply with the FEMA requirements. The plan is due to the state by November, Jones said.

BRAG recently asked mayors in the Bear River area to inventory any problem areas in their communities.

"Who knows what's going on in the cities better than the people who live there?" Gilbert said.

Gilbert will then compile all of the information gathered from the individual cities and add it to information from the U.S. Geological Survey, Sheriffs' offices and Utah State University special collections. Using that information, FEMA officials will be able to map the data and see a larger, more complex and integrated picture. The BRAG plan may even pinpoint hazards that the individual community leaders didn't know about, Gilbert and Jones said.

Many of the issues that apply to

See PRIORITY on A12

Priority

Continued from A3

Cache County involve floodplains. The emergency plan, called hazard mitigation, should become a city planning guide to help officials avoid building in potential flood areas, or at least take steps to minimize the damage of a potential flood. It doesn't "have any teeth," that bind cities into specific action, though, Gilbert said.

With the plan in place, communities will be eligible for more relief aid from the federal government when and if the President declares a disaster area. If a city has identified the steps that could be taken to avoid future problems, it will be able to use relief money more efficiently and FEMA will be more generous with the aid, Gilbert said.

Utah has been blessed with few occasions for Presidential disaster-area declarations, Gilbert said. However, the state is full of fault lines.

"I guess you could say we're one big shake away from needing this," he said.

NATURAL HAZARD MITIGATION PLANNING
PUBLIC OUTREACH AND INPUT
BEAR RIVER DISTRICT
MEETING WITH TRI-COUNTY EMERGENCY MANAGEMENT OFFICIALS
SEPTEMBER 12, 2002 @ BRAG ATTENDANCE LIST

Name	Title	Representing
Bruce Leonard	Public Works Director	Brigham City Corp. (Box Elder)
Jim Buchanan	Emergency Management Dir.	Brigham City Corp. (Box Elder)
Roger Jones	Director	BRAG
Paul Fulgham	Emergency Management Dir.	Tremonton City (Box Elder)
Stephen W. Hodges	Police Chief	Tremonton City (Box Elder)
Denton Beecher	Emergency Management Dir.	Box Elder County
Bob DeGasser	Emergency Management Dir.	Cache County Corp.
Mark Teuscher	Countywide Planner	Cache County Corp.
Jim Gass	City Manager	Smithfield City (Cache County)
Kelly Pitcher	Fire Chief	Cache County Corp.
Kevin Hansen	Public Works Dir.	Logan City Corp. (Cache County)
Scott Douglas	Emergency Management Dir.	Logan City Corp. (Cache County)
Paul Morgan	GIS Coordinator	Logan City Corp. (Cache County)
Kevin Maughan	Emergency Management Dir.	Hyrum City Corp. (Cache County)

Comments made at the Natural Hazard Mitigation Meeting 9-12-02

- The Mayors need to be informed about the Hazard Mitigation Program before they are asked to sign on. They should be informed about their responsibilities.
- BRAG should develop a fact sheet describing the Program that is sent to the Mayors.
- A fill-in-the-blank type letter that asks if they have any hazards beyond what is listed would get a better response.
- BRAG should attend the Cache County Mayors Association the Box Elder Commission, and the League of Cities meetings to give presentations.
- Brag should include previous mitigation plans that were developed for the individual cities.
- Does this program just cover Natural Hazards?
-

Emergency Manager Meeting Invite List 9-12-2002

Box Elder County
Name: Mr. Denton Beecher
Title: Emergency Services Director
Address:
01 South Main
Brigham City, UT 84302
Phone: 435-734-3357
Email: sbosgieter@boxeldercounty.org

Brigham City
Name: Mr. Jim Buchanan
Title: Emergency Services Director
Address:
P.O. Box 1005
Brigham City, Ut 84302
Phone: 435-734-2001 ext.2401
Email: jbuchanan@favorites.com

Name: Mr. Bruce Leonard
Title: Public Works Director
Address:
P.O. Box 1005
Brigham City, Ut 84302
Phone: 435-734-2001 ext.2214
Email: cibb.brucel@state.ut.us

Tremonton
Name: Chief Warren Hodges
Title: Emergency Services Director
Address:
P.O. Box 100
Tremonton, UT 84337
Phone: 435-257-2632
Email: police@tremontoncity.com

Name: Mr. Paul Fulgham
Title: Public Works Director
Address:
P.O. Box 100
Tremonton, UT 84337
Phone: 435-257-2676
Email: pfulgham@tremontoncity.com

Name: Mr. Richard Woodworth
Title: City Manager
Address:
P.O. Box 100
Tremonton, UT 84337
Phone: 435-257-3324

Email:

Willard
Name: Mr. LeLand Jacobson
Title: Zoning Administrator
Address:
P.O. Box 593
Willard, UT 84340
Phone:
Email:

Name: Ms Lynne Buland
Title: Emergency Services Director
Address:
P.O. Box 593
Willard, UT 84340
Phone: 435-620-4198
Email: bk_unltd@brigham.net

Cache County
Name: Captain Robert DeGasser
Title: Emergency Services Coordinator
Address:
50 W. 200 N.
Logan, UT 84321
Phone: 435-750-7406
Email: bdegasser@cache.state.ut.us

Name: Sheriff Lynn Nelson
Title: Emergency Services Director
Address:
50 W. 200 N.
Logan, UT 84321
Phone: 435-752-4103
Email: glnelson@cache.state.ut.us

Name: Chief Kelly Pitcher
Title: Cache Fire Chief
Address:
50 W. 200 N. Suite A
Phone: 435-750-7494
Email:cachechief@sisna.com

Hyrum City
Name: Mr. Brent Jensen
Title: City Manager
Address:
83 W. Main
Hyrum, UT 84319
Phone: 435-245-6033
Email:

Name: Mr. Cardell Nielsen
Title: Emergency Services Coordinator
Address:
83 W. Main
Hyrum, UT 84319
Phone: 435-245-3087
Email:

Logan City

Name: Mr. Scott Douglas
Title: Emergency Services Director
Address:
950 W. 600 N.
Logan, Ut 84321
Phone: 435-716-9670
Email: sdouglas@loganutah.org

Name: Mr. Kevin Hansen
Title: Public Works Director
Address:
255 N. Main
Logan, Ut 84321
Phone: 435-716-9151
Email: khansen@loganutah.org

Name: Mr. Paul Morgan
Title: GIS Coordinator
Address:
255 N. Main
Logan, Ut 84321
Phone: 435-716-9171
Email: pmorgan@loganutah.org

Mendon City

Name: Mr. Brandon Swan
Title: Emergency Services Manager
Address:
183 S. 100 W.
Mendon, UT 84325
Phone: 435-716-9500
Email: brandon_swan@hotmail.com

No. Logan City

Name: Mr. Jeff Jorgensen
Title: Emergency Services Director
Address:
2076 N. 1200 E.
No. Logan, UT 84341
Phone: 435-752-1310
Email: jeff@ci.north-logan.ut.us

Richmond City

Name: Mr. Marlo Perkins
Title: City Manager
Address:
P.O. Box 9
Richmond, UT 84701
Phone:
Email:

Smithfield City

Name: Mr. Warren Hullinger
Title: Emergency Services Director
Address:
526 E. Parkview Cir
Smithfield, UT 84335
Phone: 435-750-9981
Email:

Name: Mr. Jim Gass
Title: City Manager
Address:
P.O. Box 96
Smithfield, UT 84335
Phone: 435-563-6226
Email: jgass@smithfieldcity.org

Wellsville

Name: Mr. Don Hartle
Title: City Manager
Address:
P.O. Box 6
Wellsville, UT 84339
Phone:
Email:

Rich County

Name: Mr. Dan Ames
Title: Emergency Services Director
Address:
109 N. 200 E.
Laketown, UT 84038
Phone:
Email:

NATURAL HAZARD MITIGATION PLANNING
BEAR RIVER DISTRICT EMERGENCY MANAGEMENT MEETING
AGENDA

Thursday, September 12, 2002
12:00 p.m.
BRAG Conference Room - rear entrance
170 North Main
Logan, Utah 84321

12:00 p.m.	Welcome and Introductions- Roger C. Jones (BRAG Executive Director)
12:15 p.m	Local Natural Hazard Planning - Jeff Gilbert (BRAG Community Dev. Dir.) Disaster Mitigation Act of 2000
12:50 p.m.	Questions and wrap-up
1:15 p.m.	Adjourn

LUNCH WILL BE SERVED

NATURAL HAZARD MITIGATION PLANNING
PUBLIC OUTREACH AND INPUT
BEAR RIVER DISTRICT
MEETING WITH CACHE MAYOR'S ASSOCIATION OCTOBER 12, 2002 @ JUNIPER INN, LOGAN, UTAH
ATTENDANCE LIST

Name	Representing
County Executive Lynn Lemon	Cache County
Mayor LeRoy Atwood	Paradise City
Mayor Parry Spackman	Trenton City
Councilman Tom Kerr	Logan City
Mayor David Kooyman	Hyde Park City
Mayor Victor Jensen	River Heights City
Mayor Sydney Larsen	Mendon City
Mayor Gordon Olson	Hyrum City
Mayor Paul Dent	Lewiston City
Mayor Alma Leonhardt	Providence City
Mayor Ruth Maughan	Wellsville City
Mayor Ray Winn	Smithfield City
Mayor Val Potter	North Logan City
Mayor A. Lynn Welker	Nibley City
Mayor Kip Panter	Richmond City
Mayor John Dryer Pitcher	Cornish Town
Mayor Floyd Salisbury	Newton City
Mayor Gale Hall	Millville City
Mayor Mervin Thompson	Clarkston City
Mayor David Wood	Amalga City

Mayor Ruth Maughan of Wellsville City was not in attendance. Other arrangement will be made to contact her.

Meeting Summary: Information about the new requirements of the DMA 2000 and local natural hazard planning was conveyed to the mayors present. The information was well received, particularly when they were assured that this would require minimal time and resources from their jurisdiction and would be done without cost for them. A number of mayors asked questions related to timing, regulatory implications that may result from the plan, and what role cities will play. The mayors were giving information on the Hazard Mitigation Grant Program, Hazard Mitigation Planning Fact-sheet and a Local Government Natural Hazard Survey. Mayors were asked to complete the survey and return to BRAG in about a week.

NATURAL HAZARD MITIGATION PLANNING
PUBLIC OUTREACH AND INPUT
BEAR RIVER DISTRICT
MEETING WITH BOX ELDER COUNCIL OF GOVERNMENTS OCTOBER , 2002 @
BRIGHAM CITY PUBLIC SAFETY BUILDING, BRIGHAM CITY, UTAH
ATTENDANCE LIST

Name	Representing
Mayor Lou Ann Christensen	Brigham City
Mayor Richard Owen	Garland City
Mayor Paul Orme	Honeyville City
Mayor Keith Wadman	Portage Town
Mayor Michael Morgan	Snowville Town
Mayor Greg Iverson	Elwood Town
Mayor Deverle Wells	Corinne City
Mayor Ed Skrobiszewski	Perry City
Mayor Max Weese	Tremonton City.
Mayor Gil Miller	Bear River City
Commissioner Royal Norman	Box Elder County
Commissioner Suzanne Rees	Box Elder County
Commissioner Scott Hansen	Box Elder County

Mayor Jean Loveland Willard City, Mayor Robert Ash Mantua City, Mayor Rebecca Bronson Plymouth Town, Mayor Lyle Nesson Howell Town, Mayor Jim Garn Fielding Town, Mayor Jim Poulsen Deweyville City were not present. These individuals will be mailed information with an invitation to meet with BRAG staff for more information.

Meeting Summary: This meeting was organized by the Box Elder County COG and Emergency Management officials with a primary focus toward homeland security issues. BRAG was given some early agenda time to present the natural hazard mitigation planning requirements of DMA 2000. Because the focus was homeland security the COG meeting was also well attended by various City Council Members, Health Department Officials, Emergency Management Staff and Police/Fire Officials representing Box Elder County. BRAG staff presented those in attendance with information about the new requirements of DMA 2000 and the state's approach to regional natural hazard mitigation planning. Those present were given a Natural Hazard Mitigation Planning Fact Sheet, information on the Hazard Mitigation Grant Program and a Local Government Survey of Natural Hazards. Mayors were asked to complete the survey and return to BRAG by November 8, 2002.

NATURAL HAZARD MITIGATION PLANNING
PUBLIC OUTREACH AND INPUT
BEAR RIVER DISTRICT
MEETING WITH BRAG GOVERNING BOARD, SEPTEMBER 24, 2002 @ LAKETOWN, UTAH
ATTENDANCE LIST

Name	Representing
Mayor Lou Ann Christensen	Brigham City
Commissioner Bill Cox	Rich County
Mayor Paul Orme	Honeyville City
Commissioner Bryce Nielson	Rich County
Commissioner Norman Weston	Rich County
Mayor McKay Willis	Laketown
Mayor Craig Showalter	Woodruff Town
Councilman Darrel Gibbons	Cache County
County Executive Lynn Lemon	Cache County
Commissioner Suzanne Rees	Box Elder County
Commissioner Royal Norman	Box Elder County

Meeting Summary: Governing Board Members were introduced to the new requirements for local natural hazard mitigation planning. Board members were giving a Natural Hazard Mitigation Planning Fact Sheet. A number of questions were asked related to the planning process, timing and plan implementation. Board members were generally satisfied with BRAG's approach.

NATURAL HAZARD MITIGATION PLANNING
PUBLIC OUTREACH AND INPUT
BEAR RIVER DISTRICT
CERTIFIED CITIZEN PLANNER SEMINAR
NOVEMBER 7 & 8 NORTH LOGAN LIBRARY

Name	Title	Representing
Aguilar, Jay	Director	CMPO
Atwood, Gladys Ann	City Council	River Heights City
Bennett, Dave	Planning & Zoning Commission	Hyrum City
Bentley, Carolyn	Planning Commission	River Heights City
Bertine, Leisa	Board of Adj/Planning Comm.	Brigham City
Bohn, Laura		Utah State University
Brown, Richard	Planning & Zoning Commission	Millville City
Chase, Joshua		Utah State University
Coleman, Deen	Planning Commission	Brigham City
Ellison, Carmalee	Planner	Hyrum City
Godfrey,	Planning & Zoning	Clarkston Town
Hansen, Mike	Planner	GOPB
Hansen, Maurine	Concerned Citizen	Brigham City
Hemme, Chris	Planning Commissioner	River Heights City
Izatt, Char	Deputy Recorder, Planning & Zoning	Smithfield City
Krum, Robert	Planning Commission Chairman	Willard City
Lane, Kevin W.	Planning Commission	Brigham City
Lind, Sheila	City Recorder	Rivr Heights City
Lynne, Mark	Planning & Zoning	Hyde Park City
Mair, Chris	Planning Chairman	Stockton Town
Marshall, Jim	Planning & Zoning Commission	Honeyville City
McKay, Bryant	Planning & Zoning	Smithfield City
Meadows, Harry	Planning & Zoning Commissioner	Millville City

Name	Title	Representing
Moss, Rolayne D.	Board of Adjustments	Honeyville City
Moss, Carrel Y.		Honeyville City
Orme, H. Paul	Mayor	Honeyville City
Peterson, Celia	Student	Utah State University
Rickson, Michael	Planning & Zoning Commission	River Heights City
Robison, Ray	Planning Commission	Logan City
Sadler, Don	Cache County P & Z	Richmond City
Steinagel, Mark	Policy Analyst	State Legislature
Stokes, Barbara	Planning Commission Chair Person	Brigham City
Stott, Greg	Planning & Zoning	Millville City
Summers, Annette G.	Board of Adjustment	Clarkston Town
Teuscher, Mark	Countywide Planning	CPDO
Thorsted, Lloyd	Planning Commission	Honeyville City
Tinney, Kenneth	Board of Adjustment	Honeyville City
Toth, R. E.	Professor	Utah State University
Vernon, Rik	Planning & Zoning Commission	Smithfield City
Willers, Daniel		Utah State University
Williams, Sharon	Concerned Citizen	
Wright, Blake	Planning Commission	River Heights City
Young, Stanford	Planning Commission	Hyrum City

Comments made

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NATURAL HAZARD MITIGATION PLANNING
PUBLIC OUTREACH AND INPUT
BEAR RIVER DISTRICT
MEETING WITH BRAG GOVERNING BOARD, November 25, 2003 @ BRAG, Logan, UTAH
ATTENDANCE LIST

Name	Representing
Mayor Lou Ann Christensen	Brigham City
Mayor Paul Orme	Honeyville City
Commissioner Norman Weston	Rich County
Commissioner Thomas Weston	Rich County
Councilmen Cory Yeates	Cache County
Councilman Darrel Gibbons	Cache County
County Executive Lynn Lemon	Cache County
Mayor Alma Leonhardt	Providence City
Commissioner Scot Hansen	Box Elder County
Commissioner Suzanne Rees	Box Elder County
Commissioner Clark Davis	Box Elder County

Meeting Summary: A full draft version of the PDM plan was given to each board member. The board discussed a number of the plans findings and recommendations and board member were informed of how the process will proceed to final approval. Board members were again encouraged to review the plan and make comments and help develop and refine mitigation projects and strategies.

Natural Hazard Mitigation Goals and Objectives

BRAG is assisting communities in compliance with new Federal requirements of the Disaster Mitigation Act of 2000. We need your help in identifying local projects to be included in the plan. Developing strong mitigation goals and objectives is crucial in the planning process and will likely influence future mitigation project funding. **Lack of participation in the plan could reduce the level of "post-disaster" assistance from FEMA in the event of a disaster in your community.**

"Hazard Mitigation" means to permanently reduce or alleviate the losses of life, injuries and property resulting from natural and human-made hazards through long-term strategies. These long-term strategies include planning, policy changes, programs, projects and other activities. **Potential projects should be designed to mitigate the impacts of flooding, wildfire, landslides, earthquakes, dam failure, severe weather, insect infestation, drought or any other category of disaster you identify.**

Please complete and return to BRAG by December 19, 2003
BRAG, 170 N. Main, Logan UT 84321 or Fax (435) 752-6962

Format Example:

Goal: : Protect citizens and property from flooding

Objective:	Reduce flood threat from Chalk Creek within Floodsville City
Action:	Maintain and improve existing levee along Chalk Creek
Priority:	High
Timeframe:	Six months to one and half years
Potential Funding:	Routine maintenance County public works
Estimated Cost:	Minimal
Participation\Staff:	County Public Works
Background (if needed)	Flatten the sideslopes, filling in depressions and rodent holes, and removing any deep-rooted plants along the levee. Fill and protect locations where the levee is eroded with riprap or other armoring.

Objective:	Reduce flood threat from Chalk Creek within Floodsville City
Action:	Initiate flood plain mapping study to determine whether a flood threat does exist.
Priority:	Medium
Timeframe:	Three to five years
Potential Funding:	Undetermined local source potentially HMGP
Estimated Cost:	$4,000
Participation\Staff:	State and Contractor
Background (if needed)	FEMA has designated Floodville as a nonflood hazard area

Objective:	Reduce flood threat from Chalk Creek within Floodsville City
Action:	Advise residents of the availability of flood insurance.
Priority:	High
Timeframe:	Immediate
Potential Funding:	County
Estimated Cost:	Minimal
Participation\Staff:	County Floodplain manager
Background (if needed)	Inform residents adjacent to the channel of the potential risk of flooding and advise them flood insurance is available. Because of Floodsville's designation, flood insurance is priced very reasonable.

(Civil)

PROOF OF PUBLICATION

STATE OF UTAH
COUNTY OF CACHE, ss.

On this 10th day of December A.D. 2003

personally appeared before me Rachelle S. Thomas who being first duly sworn, deposes and says that she is the chief clerk of the Cache Valley Publishing Co., publishers of The Herald Journal a daily newspaper published in Logan, City, Cache County Utah, and that the advertisement

BEAR RIVER DISTRICT NATURAL HAZARD PRE-DISASTER MITIGATION PLAN

a copy of which is hereto attached, was published in said newspaper for One (1) issue commencing December 10, 2003 and ending December 10, 2003

Signed Rachelle S. Thomas

Subscribed and sworn to before me, the day and year above written.

Signed Cynthia K. Fulton
Notary Public.

My Commission expires September 7, 2007

Notary Public * State of Utah
CYNTHIA K FULTON
320 West 1330 North
Logan, UT 84341
My Comm. Exp. September 7, 2007

Bear River District Natural Hazard Pre-Disaster Mitigation Plan

As required by the Disaster Mitigation Act of 2000, a regional Pre-Disaster Mitigation Plan has been produced in draft form and is available for public review and comment. The plan identifies potential natural hazards, estimates vulnerabilities and recommends mitigation strategies for local jurisdictions in Box Elder, Cache and Rich Counties. Those interested can view the draft plan online at: http://www.brag.dst.ut.us/BRAG%20pdm%20plan.htm or at the BRAG office at 170 N. Main, Logan Utah 84321. Send comments, concerns or questions before December 31, 2003 to jeffg@brag.dst.ut.us or call Jeff Gilbert at 435-752-7242 for more information.
Publication Date: December 10, 2003

RECEIVED
DEC 12 2003
BRAG
LOGAN, UT

APPENDIX D
HAZARD MAPPING DATA SOURCES & FACILITY COST ESTIMATES

Bear River District Pre-Disaster Mitigation Plan
Metadata – Information about the GIS data

Data Layer	Creator	Date Produced	Scale	Description	Classes
Population	U.S. Census Bureau	2000	Census Block Level	Total number of individuals within each block	
Housing Units	U.S. Census Bureau	2000	Census Block Level	Total number of dwelling units within each block	
Housing Value	U.S. Census Bureau	2000	Census Block Group	Average value of owner-occupied dwelling units within the block group	
Critical Facalities				HAZUS DATA	Schools, police stations, hospitals and fire stations
Businesses				HAZUS DATA	All non-home businesses
Water Related Land Use	Utah Division of Water Resources	Bear River area produced 1996, Published 2000	1 : 24,000	Land use types from aerial photography	All built-up classes labeled with "v"
Quaternary Faults	United States Geological Survey	09-01-02	1 : 100,000	GIS data digitized from Hecker, Utah Geological Survey Bulletin 127.	All Quaternary Faults were used in the analysis with a 100' buffer on both sides of the fault
Earthquake Epicenters 1963-1993	University of Utah Seismograph Station	1993	1 : 100,000	All earthquakes large enough to register on seismograph	
Data Layer	**Creator**	**Date Produced**	**Scale**	**Description**	**Classes**
Wildfire Hazard	Bureau of Land Management and Division of Emergency Services	March 2000	Unspecified 1: 100,000	Hazard rating based on the population density, fire hazard potential (based on vegetation type), and fire occurrence (fire density) of a given location	Only classes labeled "extreme" and "high" were used in this analysis

Data Layer	Creator	Date Produced	Scale	Description	Classes
Wildfires 1986 - 2000	?	?	?	Location of Fires	
Flood Zones	FEMA and FIRM	1978-1981	1 : 10,000	Areas considered within 100 year floodplains by FEMA	Only Zone A considered in analysis
Landslide Areas	USGS	Published 2001	1 : 100,000	Landslides that have been mapped	Only active landslide areas considered in analysis
Liquefaction Potential	Utah Geologic Survey	1994	1 : 100,000	Liquefaction Potential	Only areas of high liquefaction potential considered in analysis

INFRASTRUCTURE COSTS
(HAZUS) ROAD CONSTRUCTION PER MILE
COST TEMPLATES

Road Tunnels
1 million dollars per 10 meters

Bridges see attachment page 3-30
Major bridges (think I-15) 20 million Dollars
Wood bridges 1 million
Concrete bridges 1 million

Natural gas distribution lines
$150,000 per km

Rail Track
$1.5 million per km

Waste Water Distribution lines
$150,000 per km

Potable water distribution lines
$150,000 per km

Electric power distribution lines
$30,000 per km

Communication distribution lines
$50,000 per km

Water treatment plants page 3-37

Sewer and waste water treatment plants 3-38

Power plants and substation 3-40

ROAD REPLACEMENT COSTS		
RIGHT-OF-WAY Feet	**CONSTRUCTION Cost Per Mile**	**DESCRIPTION**
110	$ 4,500,000	6 Lanes, 1 Center or Median, and 2 Shoulders
110	$ 4,700,000	4 Lanes, 1 Center or Median, 2 Shoulders, and 2 Sidewalks
110	$ 4,700,000	6 Lanes, 1 Center or Median, and 2 and Sidewalks
84	$ 3,900,000	2 Lanes, 1 Center or Median, 2 Shoulders, and 2 Sidewalks
84	$ 3,900,000	4 Lanes, 1 Center or Median, and 2 Sidewalks
66	$ 3,100,000	2 Lanes, 1 Center or Median, and 2 Sidewalks
66	$ 3,500,000	4 Lanes, and 2 Sidewalks
66	$ 3,600,000	4 Lanes, and 1 Center or Median
150+	$ 7,100,000	8 Lanes, 2 Median, and 4 shoulders
220	$ 5,500,000	4 Lanes, 2 Median, and 4 shoulders
125	$ 6,100,000	6 Lanes, 1 Center or Median, 2 shoulders, and 2 sidewalks
I-15 (widening)	$ 10,000,000	Add one lane each direction
Legacy Hwy / I-80 / SR-201	$ 30,000,000	
I-15 (reconstruction), 5600 W. Freeway	$ 50,000,000	